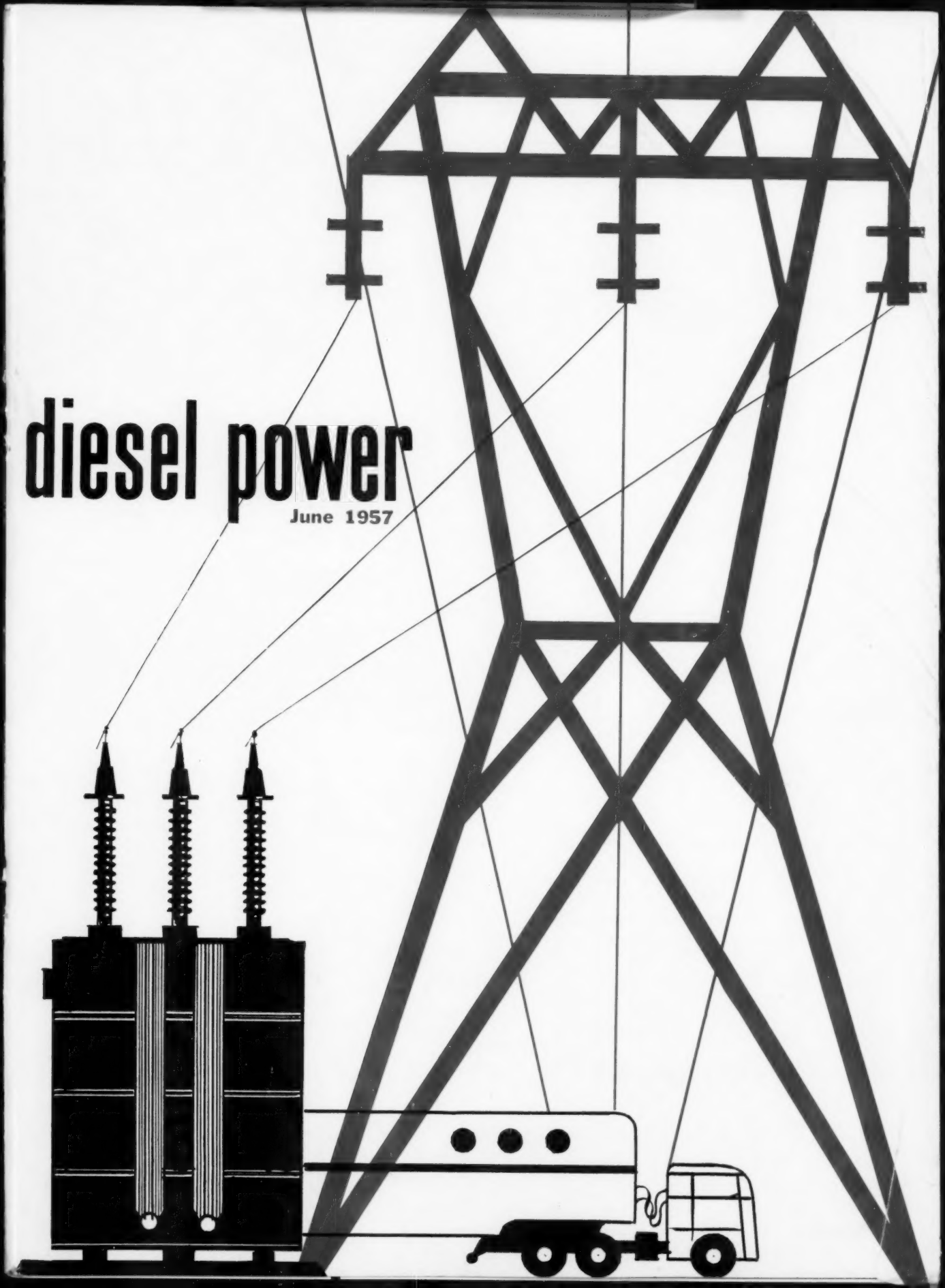
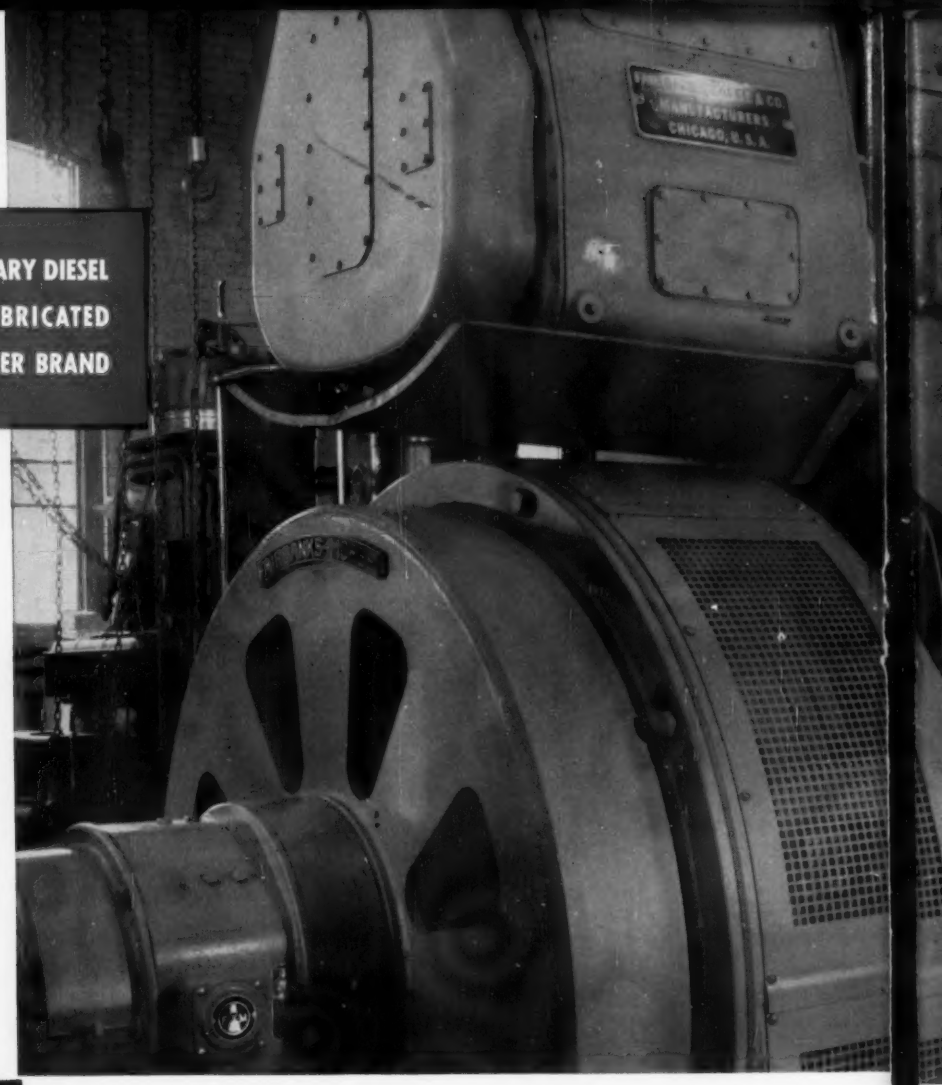
diesel power

June 1957



FOR OVER 20 YEARS, MORE STATIONARY DIESEL H.P. IN THE U.S. HAS BEEN LUBRICATED WITH TEXACO THAN WITH ANY OTHER BRAND

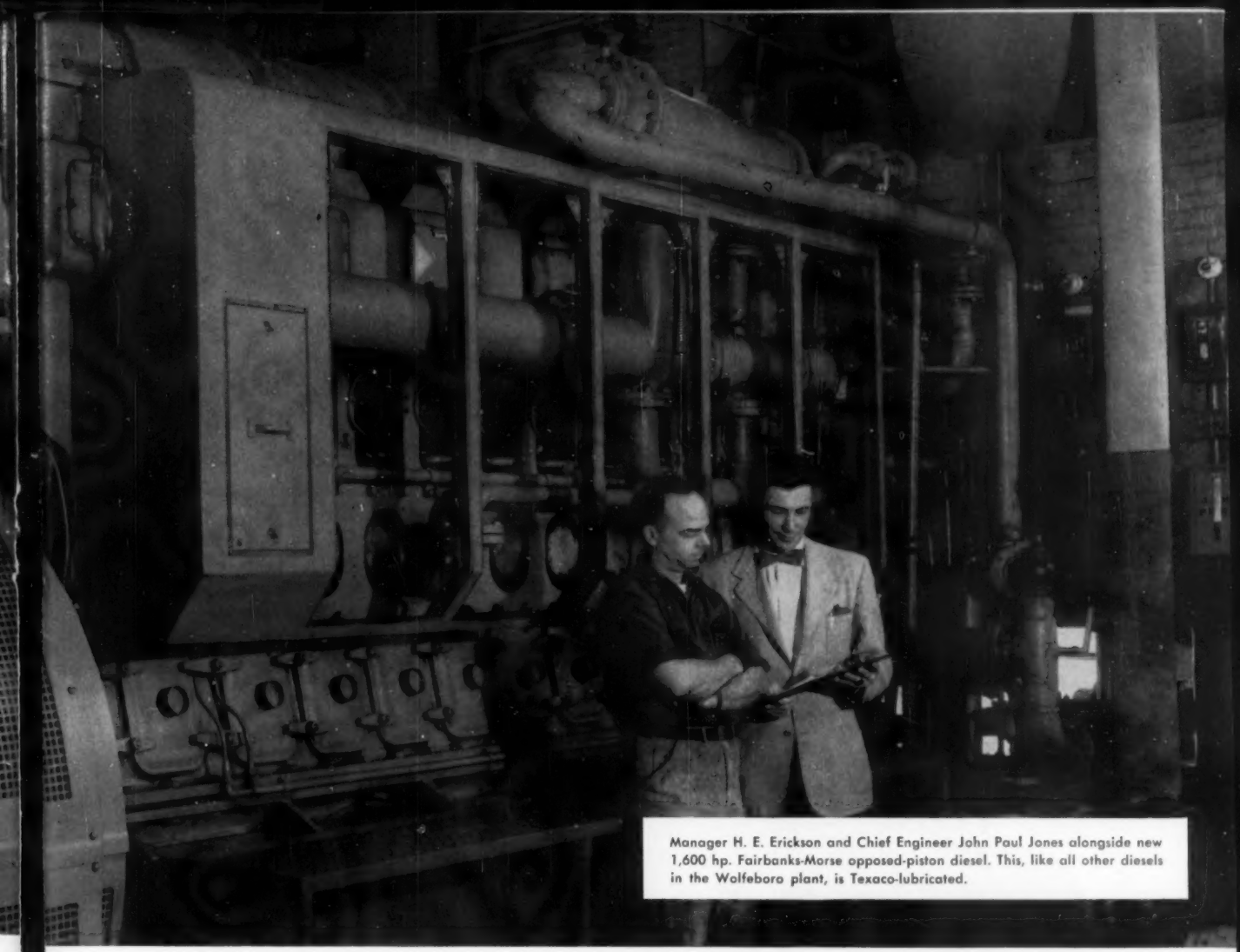


WOLFEBORO
the Oldest Summer Resort in America

GETS TOP DIESEL EFFICIENCY WITH TEXACO

TEXACO

TEXACO



Manager H. E. Erickson and Chief Engineer John Paul Jones alongside new 1,600 hp. Fairbanks-Morse opposed-piston diesel. This, like all other diesels in the Wolfeboro plant, is Texaco-lubricated.

The Wolfeboro, New Hampshire, Municipal Electric Department operates five diesels, ranging from 360 hp. to 1600 hp. Manager H. E. Erickson has this to say about their operating efficiency—

"We have been lubricating our diesels with *Texaco Ursa Oils* for some 25 years. They have helped us achieve and maintain an enviable record of performance efficiency and maintenance economy—engines stay clean, rings stay free, wear is negligible, fuel consumption and maintenance costs are low."

You, too, can enjoy these benefits. There is a complete line of *Texaco Ursa Oils*—all designed to assure *more power* with *less fuel* and *longer periods* between overhauls from diesel, gas and dual-fuel engines. Used in conjunction with top flight Texaco Lubrication Engineering Service, they assure top engine efficiency—whatever the operating conditions or fuel used.

Let a Texaco Lubrication Engineer help you. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write:

The Texas Company, 135 East 42nd Street, New York 17, N. Y.

URSA OILS FOR ALL DIESEL, GAS AND DUAL-FUEL ENGINES

FORMER POWER UNIT SALESMAN

switches engine brands

AS BUYER...

Lynn McMillen sold competitive units six years, but purchases International UD-18A for his crusher

If you've wondered what power unit salesmen would actually buy if they were in the rock products business, here's a clue.

Lynn McMillen, partner in McM Materials, Inc., St. Charles, Mo., states: "I sold competitive power units for six years, but this International UD-18A on our Cedar Rapids crusher is a good engine. We've had no major repairs on it in nearly two years' operation."

That's something to think about, an experienced engine salesman preferring a dependable International diesel when his profits depended upon production. And when you switch to Internationals you can choose from a full line of 16 diesel and carbureted power units—one for every job or driven machine. In addition to bonus-power, you'll get bonus-service from your always-available International Power Unit Distributor or Dealer. Call him soon.

This 125 hp International UD-18A six-cylinder diesel power unit puts a 5-yd truckful of gravel through the Cedar Rapids Junior Tandem Crusher in less than 200 seconds. Ten-yard trucks are filled in six minutes.

INTERNATIONAL® CONSTRUCTION EQUIPMENT

International Harvester Co., 180 N. Michigan Avenue, Chicago 1, Illinois

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Side-Boom Tractors ... Self-Propelled Scrapers and Bottom-Dumps ... Crawler and Rubber-Tired Loaders ... Off-Highway Trucks ... Diesel and Carbureted Engines ... Motor Trucks

If you want an Impact Wrench designed and built the way it should be in the first place and a factory that you know goes a little bit further than most in standing behind its tools...

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IMPACT WRENCH

- ELECTRIC DRILLS
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- IMPACT WRENCHES
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LOOK UNDER ELECTRIC TOOLS!

SIOUX

ALBERTSON & CO., INC.

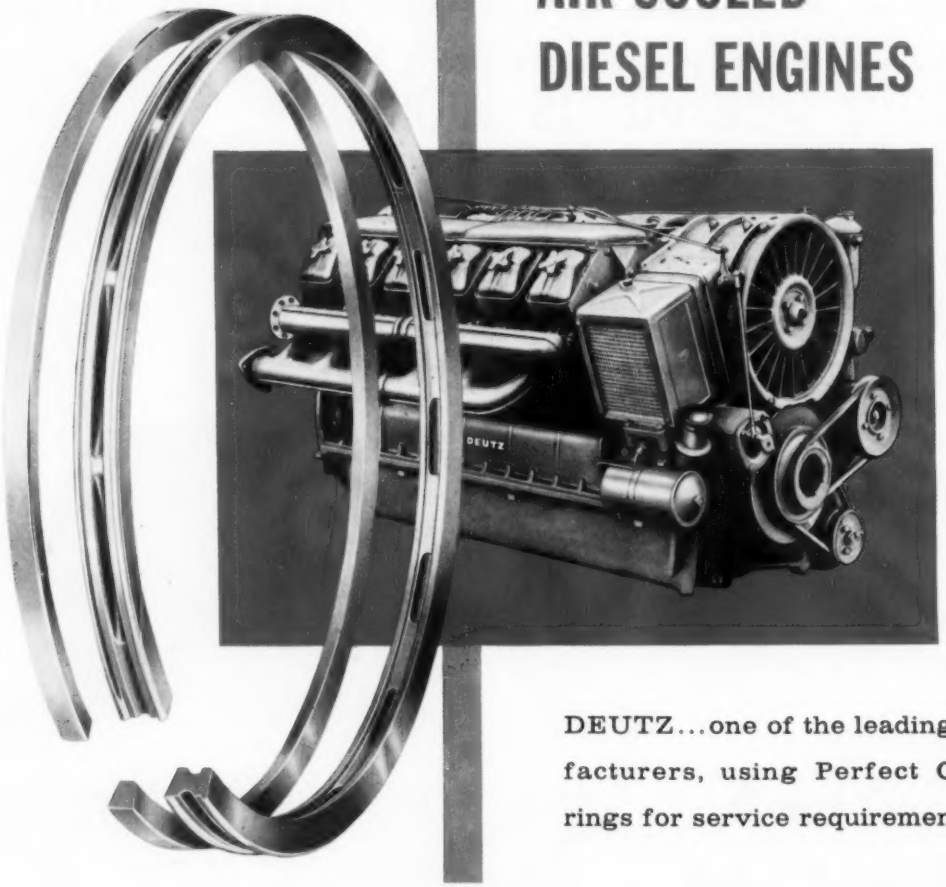
SIOUX CITY, IOWA, U.S.A.

For

Best Performance in

DEUTZ

AIR-COOLED DIESEL ENGINES



DEUTZ...one of the leading engine manufacturers, using Perfect Circle chrome rings for service requirements

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PISTON RINGS... *the standard of comparison*

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diesel power

Established in 1923 **Vol. 35, No. 6** **June, 1957**

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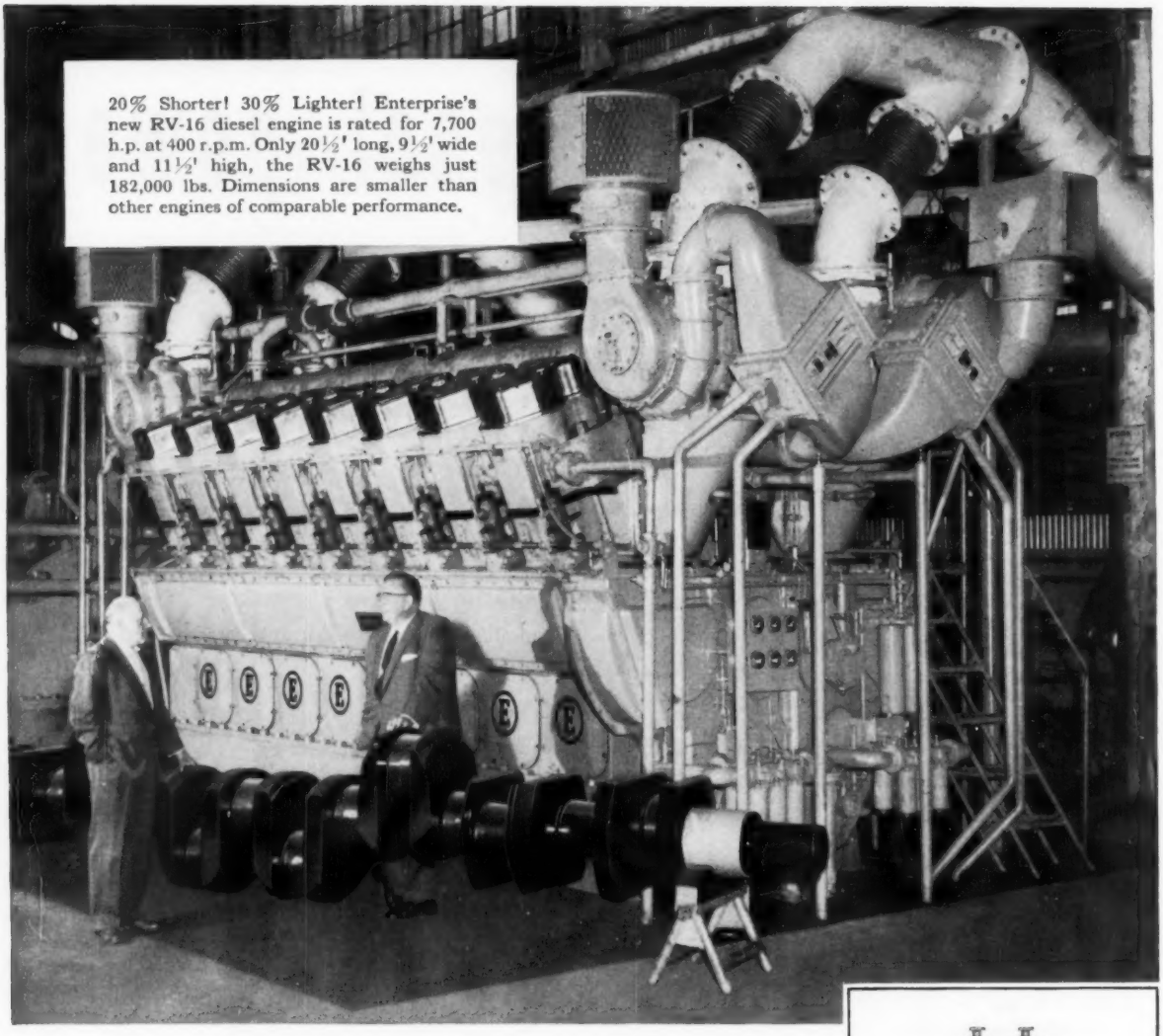
Diesel Publications, Inc., 80 Lincoln Avenue, Stamford, Conn.



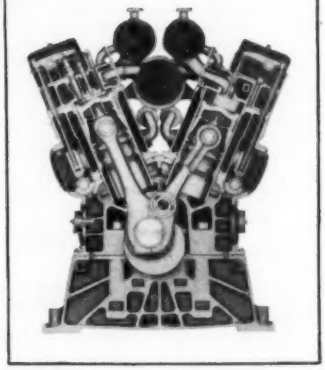
20% Shorter! 30% Lighter! Enterprise's new RV-16 diesel engine is rated for 7,700 h.p. at 400 r.p.m. Only 20½' long, 9½' wide and 11½' high, the RV-16 weighs just 182,000 lbs. Dimensions are smaller than other engines of comparable performance.

Enterprise Chooses KOPPERS Piston Rings Exclusively for RV-16

Prototype of a new line of industrial diesel engines, the RV-16, built by Enterprise Engine & Machinery Co., of San Francisco, is designed for such rugged operations as delivering main propulsion in towboats and seagoing freighters, or supplying power for pumping stations or electric generation.

As many other leading manufacturers have done, Enterprise has selected Koppers Piston Rings exclusively. Koppers wide range of types and sizes . . . variety of material selection . . . control of material quality . . . close tolerance performance . . . rigid standards of inspection—all contribute to Koppers leadership in the field of industrial piston and sealing rings, making Koppers the most dependable source of supply.

If you have a problem of ring application, avoid further needless expense. Take advantage of Koppers experience, research facilities and craftsmanship. Write for information today. KOPPERS COMPANY, INC., Piston Ring and Seal Department, 1306 Hamburg Street, Baltimore 3, Maryland.



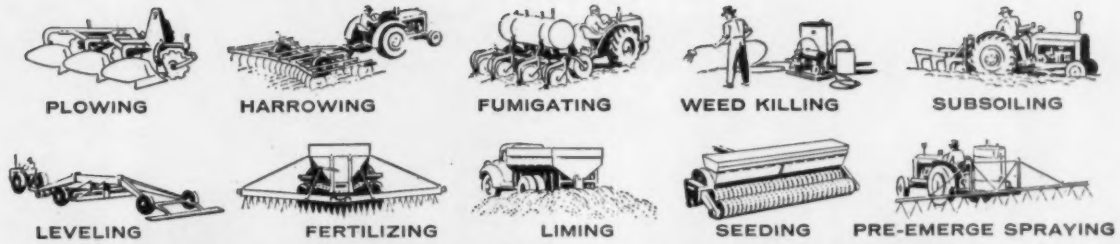
Cutaway shows internal design of the RV-16

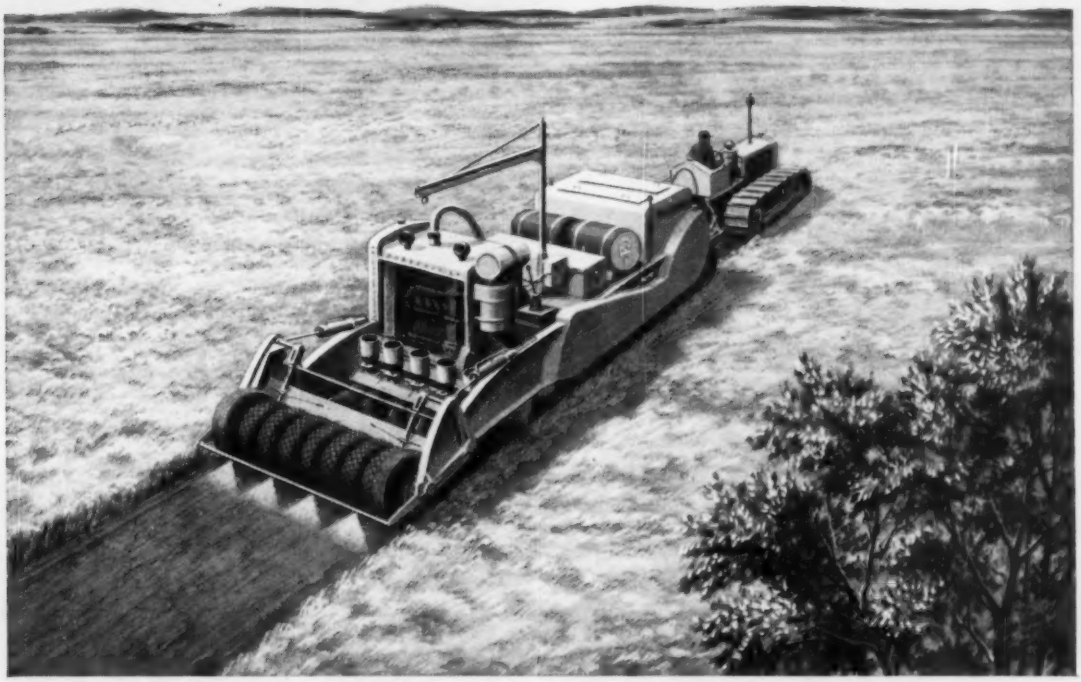
KOPPERS

AMERICAN HAMMERED

Industrial Piston Rings

Engineered Products Sold with **Service**





SHELL RIMULA OIL selected for crankcase lubrication by

WONSOVER

ONE machine designed to do 10 Farm Jobs at once!

Wonsover, a new multi-purpose agricultural machine, is designed to eliminate individual farm operations. It performs many time-consuming jobs simultaneously. Wonsover is said to perform many multi-farming operations in just one sweep.

Norton-Portland Corporation at Portland, Maine, the manufacturers of Wonsover, selected Rimula* Oil as the recommended crankcase lubricant for maximum performance. Here are several reasons Wonsover chose this lubricant:

1. Shell Rimula Oil eliminates cylinder and bearing pitting caused by acid residue from incomplete combustion and low jacket temperature.

2. With Shell Rimula Oil engine parts stay clean and operate efficiently for longer periods . . . effecting worthwhile savings in labor and parts.

If you operate heavy-duty engines, gasoline or diesel, let your Shell Industrial Representative show you the many benefits of using Rimula Oil. For more information, write to Shell Oil Company, 50 West 50th St., New York 20, N. Y.; or 100 Bush St., San Francisco 6, California. *Trademark

Other Shell lubricants used by Wonsover:

SHELL SPIRAX EP—for transmissions

SHELL TELLUS OIL—for hydraulic circuits

SHELL RETINAX A—for all grease lubrication, including wheel bearings

SHELL RIMULA OIL

SHELL

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DETROIT DIESEL PARTS

—factory-engineered for long life, low-cost service

Camshaft inspection—Close adherence to engineering specifications on every General Motors Detroit Diesel replacement part is maintained by routine checks with high precision instruments like this optical inspection gauge with a guaranteed accuracy in millionths of an inch.

Gear dimension control—Gear teeth shaving is measured precisely on the latest-type machines where tape recordings show the contours to an accuracy of one ten-thousandths of an inch.

Magnetic analysis comparator—Here the latest electronic testing equipment is used for a uniform, rapid method in checking metal parts for strength . . . customers' assurance of utmost dependability.

You're always money ahead
when you buy
factory-engineered parts
from your Distributor or Dealer

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DETROIT DIESEL POWER

DETROIT DIESEL

Engine Division of General Motors
Detroit 28, Michigan

Single Engines . . . 30 to 300 H.P. Multiple Units . . . Up to 893 H.P.

In Canada: GENERAL MOTORS DIESEL LIMITED, London, Ontario

3 dependable products for the diesel industry

DE LAVAL IMO PUMPS

De Laval IMO pumps do a dependable job during long years of service. The reason is IMO design simplicity. De Laval IMO's have only three moving parts—smoothly intermeshing rotors that propel the fluid axially in a steady flow without churning, pocketing or pulsation. There are no reciprocating parts to wear or become noisy. Quiet, compact IMO pumps are excellent for direct-connected, high-speed operation. They can be furnished in capacities to 1,000 gpm and pressures to 1,500 psig.

DE LAVAL HYDRAULIC FAN DRIVES

De Laval Hydraulic Fan Drives for air cooled heat exchangers and cooling towers offer these important advantages. They *save* power since the fan operates at full speed only a portion of the time. They provide *accurate, automatic* control of engine jacket water temperature, and also assure complete operational flexibility. These units stay on the job for years. As shown, both IMO motor and speed reducer are mounted and factory aligned on a single bedplate.

DE LAVAL HIGH PRESSURE TURBOCHARGERS

De Laval turbochargers offer pressure ratios of 3:1 as well as higher compressor and turbine efficiencies than those found in conventional turbocharger systems. Output of heavy duty diesel, gas and dual-fuel engines may be doubled by De Laval turbochargers without increasing thermal loading. Exclusive Monorotor design offers a compact lightweight unit of sturdy construction. De Laval turbochargers are self-adjusting to engine loads, can be used on 4- *and* 2-cycle engines.

You'll find additional data in these De Laval Bulletins. Write for your copies.

DE LAVAL

Steam Turbine Company

TRENTON 2, NEW JERSEY

Dust OUT, Clean Air IN—
AAF CYCOILS do the job!

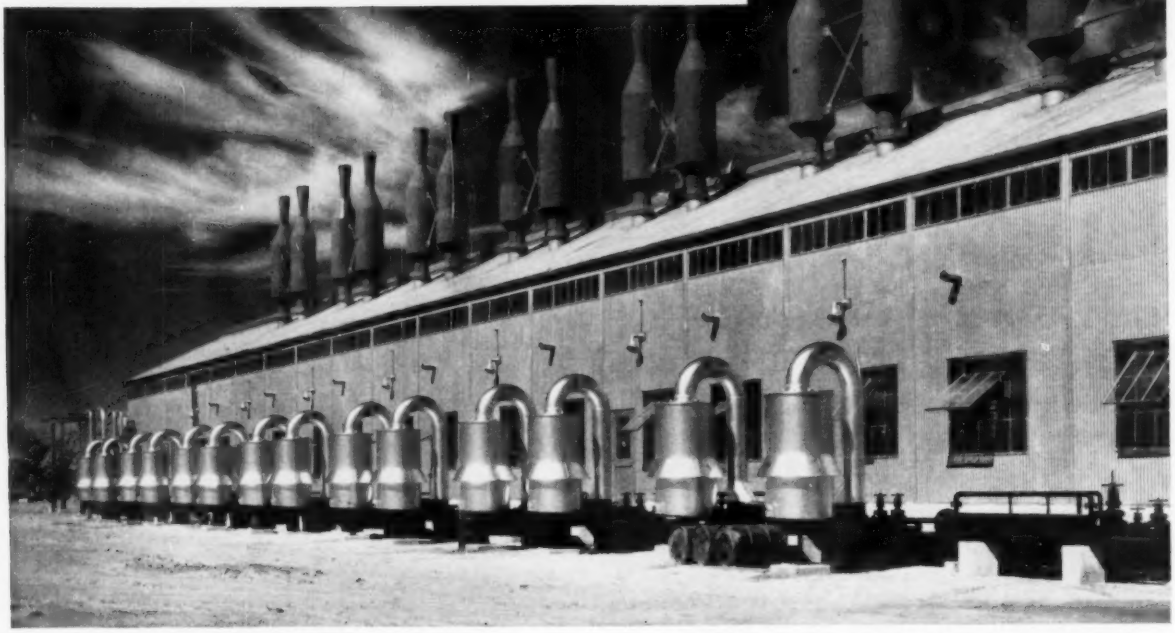

Photo by Elwood M. Payne, Houston

AAF Cycoils play an important part at the Shell Oil Company's Sheridan, Texas cycling plant. Dust stays out of engines and compressors, only clean air goes in.

WHEN you have fourteen compressors working full-time, you want to be sure you have complete protection against dust. That's why the Shell Oil Company chose Type W AAF Cycoils for its important gasoline cycling plant at Sheridan, Texas. Only *maximum* protection is enough with an investment like this at stake.

AAF Cycoil heavy-duty oil bath air cleaners deliver 4-way cleaning: impingement, scrubbing, cyclonic action and filtering. Actual tests, plus on-the-job operation, prove that more than 90% of the fine dust content of air is trapped in oil and removed by centrifugal action—*before it even reaches the filter pads.* No wonder Cycoils deliver air that's virtually 100% *dust-free.*

Only AAF Cycoil Oil Bath Air Filters offer engines and compressors such protection, save so much money and trouble. For full information, write today for Bulletin No. 130. It's packed with facts—has all the details.

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COMPANY, INC.

445 Central Avenue, Louisville 8, Kentucky
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Type CMS Multi-Duty Filters

Type G Pipeline Air Filters

— BETTER AIR IS OUR BUSINESS —

Type OCH Intake Air Filters

Cycoil Oil Bath Air Filters

HEAT'S AWAY!

Harrison heat-exchangers cool this ultra-modern luxury cruiser!

When engine temperatures are *right*—cruising's on an even keel! And Harrison heat-exchangers are always on the job from launching to landing, helping provide trouble-free operation on this sleek luxury cruiser. You'll find Harrison heat-control products keeping temperatures level on all kinds of equipment . . . marine, automotive, aviation, industrial! That's because Harrison products are backed by over 46 years of engineering research and experience . . . assuring complete dependability in safeguarding performance against heat. If you have a cooling problem, look to Harrison for the answer.

TEMPERATURES MADE TO ORDER

GM GENERAL MOTORS

HARRISON

RADIATOR DIVISION, GENERAL MOTORS CORP., LOCKPORT, N.Y.

VAN NORMAN 467 CRANKSHAFT GRINDER

Sets a New High in Diesel Shaft Re-Grinding at a NEW LOW PRICE!

1 A great, new Heavy Duty Grinder, at a sensationally new low cost, with the range to re-grind Diesel Shafts up to 84" long... a 22" swing over centers. A range not previously encompassed, except by larger or much more costly machines! Constant alignment, vibrationless operation, greatly reduced set-up time.

2 The greatest speed of operation ever built into a Crankshaft Grinder. One man, positive control, as the wheel traverse mechanism is always positioned in front of the grinding wheel.

3 This modern Grinder will save you many hundreds of dollars in your service shop, yet you can actually put it to work for only a few dollars a day on an easy payment, Pay-As-You-Depreciate Plan. Van Norman Automotive Equipment Company, Springfield 7, Mass., U.S.A. A Division of Van Norman Industries, Inc.

Write Get the whole cost reducing story on this great, new No. 467 Grinder NOW!

VAN NORMAN PRECISION MACHINING TO THE HIGHEST STANDARDS of ACCURACY

●

INSTANTANEOUS POSITIONING OF HEAD OR FOOTSTOCK TO ACCOMMODATE SHAFTS OF ANY LENGTH UP TO 84"

●

22" SWING OVER CENTERS

●

UNIT TYPE WHEEL HEAD SPINDLE

●

3 WORKHEAD SPEEDS 20-40-60 RPM

●

BUILT-IN COUNTERWEIGHTS

VAN NORMAN

PRECISION VAN NORMAN MACHINING *IN MODERN, EFFICIENT SHOPS—EVERYWHERE!*

DIESEL FUEL and LUBRICATION

BULLETIN

CITIES SERVICE

TESTS SHOW CITIES SERVICE C-300 OIL HAS LOWEST BEARING LOSS

L-4 72 Hr. Engine Run

Bearing Loss, Ave mg.

CITIES SERVICE C-300 OIL	Brand A Oil	Brand B Oil	Brand C Oil	Brand D Oil	Brand E Oil	Brand F Oil	Brand G Oil
54	550	106	170	1109	601	89	1425

New test data reveals excellent reasons why sales of Cities Service C-300 Oil have doubled in two years.

These tests, comparing C-300 with 7 leading competitive oils, demonstrate that it has by far the lowest bearing loss of all oils tested.

In addition, the over-all performance rating of Cities Service C-300—which takes into account all aspects such as corrosion and oxidation resistance, oil consumption, and detergency—was also highest of all oils tested.

For diesel trucks, buses, farm equipment, and stationary diesels, Cities Service C-300 is unsurpassed. Ask your Cities Service Lubrication Engineer for performance data.

CITIES SERVICE DEVELOPS NEW OIL FOR SEVERE-DUTY EARTH MOVING MACHINERY

To meet the exacting requirements of certain severe-duty earth movers now manufactured by the Caterpillar Tractor Company and others, Cities Service has developed an extremely rugged new oil.

Known as Cities Service C-500, this new oil is approved by Caterpillar and specially made for service as a Series 3 Oil.

Your lubrication engineer will gladly discuss the features of this new oil and the precise machinery and conditions for which it is intended.

OVER 10,000 HOURS WITH CITIES SERVICE C-400 OIL— PISTONS CLEAN AS NEW!

A Mississippi tug was having trouble. Ring breakage and oil consumption made overhaul necessary practically every time it was docked.

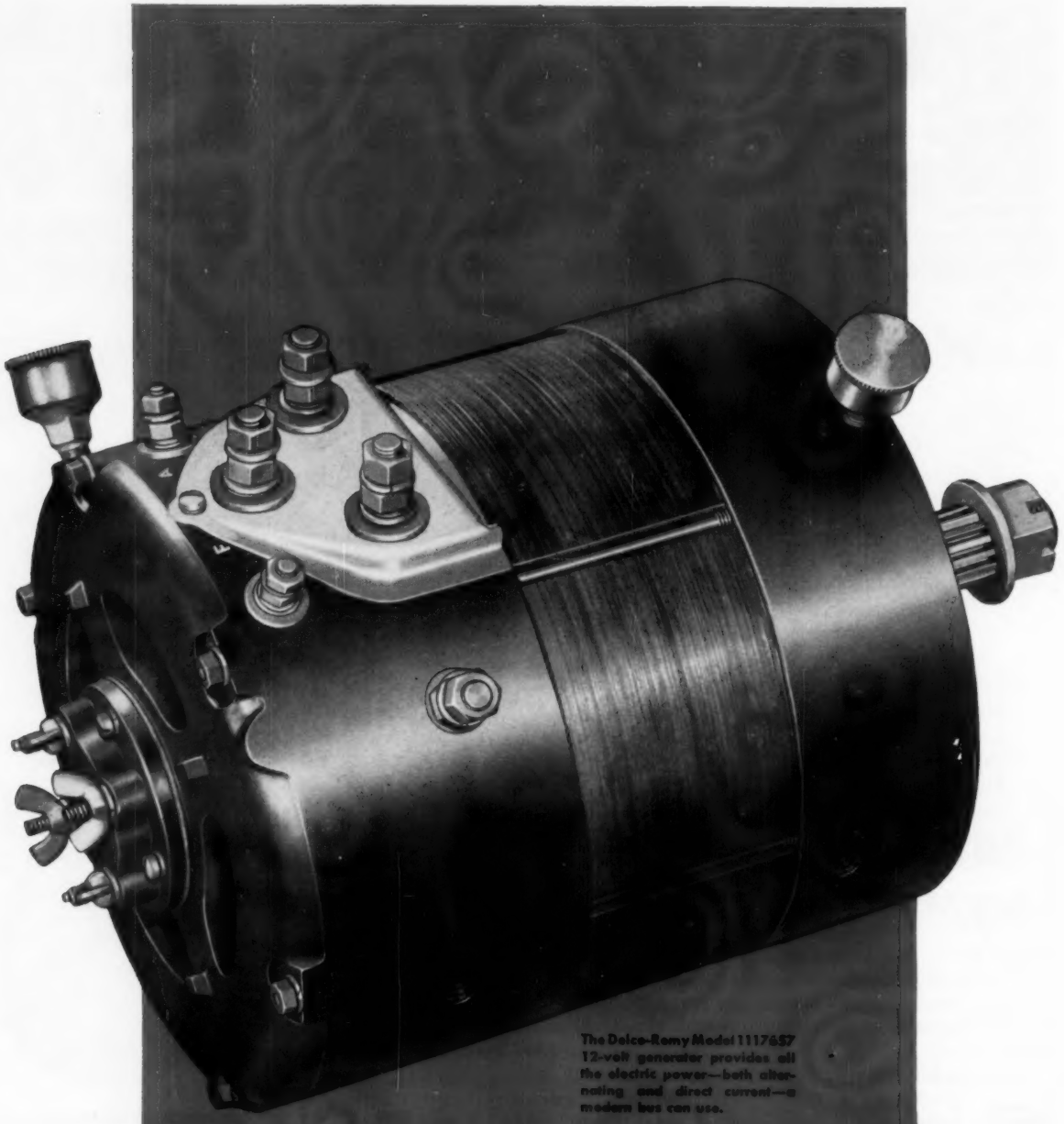
Then Cities Service C-400 Diesel Engine Oil was tested.

Result: After over 10,000 hours, pistons were like new. No stuck or broken rings. Horsepower was increased 5%. Oil consumption chopped in half!

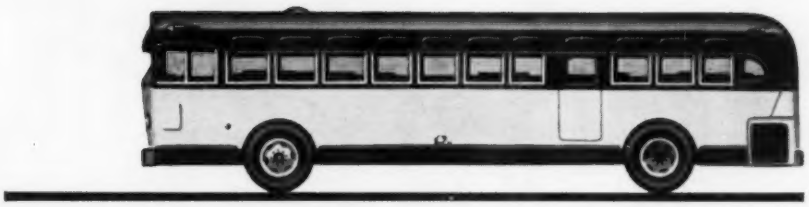
This story is typical of the kind of problems Cities Service solves throughout the year. If you have lubrication difficulties, consult your Cities Service Lubrication Engineer . . . it may save you a bundle.

MAN YOU SHOULD KNOW

William J. Varetoni is a Lubrication Engineer and Technical Consultant with the Cities Service office at 60 Wall Street, New York, N. Y. With 27 years' experience in the solution of lubrication problems, he is typical of the many Cities Service Lubrication Engineers who will gladly investigate your problems without obligation. A call to the nearest Cities Service office will bring one of these men to your plant or job site.



The Delco-Remy Model 1117657 12-volt generator provides all the electric power—both alternating and direct current—a modern bus can use.



ASK FOR DELCO-REMY MODEL 1117657—THE GENERATOR THAT HANDLES THE TOUGH JOBS WITH EASE!

This Delco-Remy 12-volt generator—Model 1117657—is the heart of an A.C.-D.C. charging system designed specifically for buses with continuous and extremely heavy electrical loads. It has a low cut-in speed of about 550 rpm, a curb-idle output of 130 amp., and a maximum output of 180 amp. at approximately 2000 rpm. Physically, it is rugged yet extremely low in weight for such a tremendous output. With its matching regulator and rectifier, Model 1117657 will give you all the power a modern bus can use—alternating current for fluorescent lighting, plenty of direct current for other electrical equipment. Specify Delco-Remy A.C.-D.C. charging systems for your buses. They're typical of Delco-Remy leadership in the automotive electrical field.

GM GENERAL MOTORS

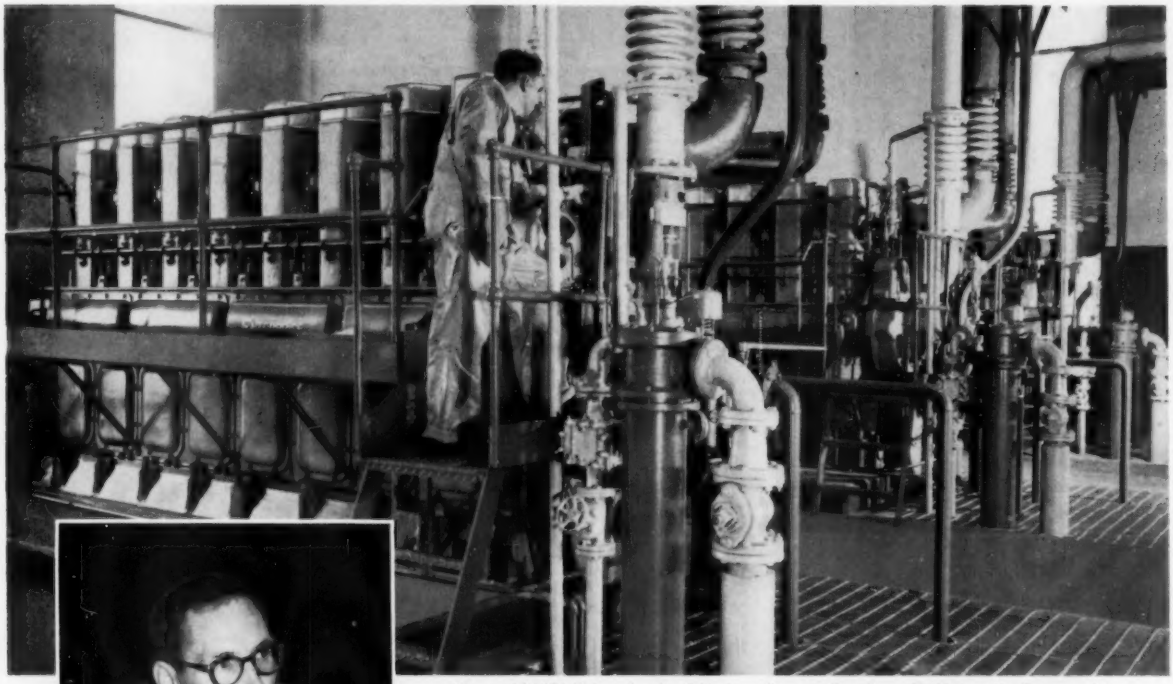
GENERAL MOTORS LEADS THE WAY—STARTING WITH

Delco-Remy

ELECTRICAL SYSTEMS

DELCO-REMY • DIVISION OF GENERAL MOTORS • ANDERSON, INDIANA

Enterprise Engines Run 90% on Free Sewage Gas



Three 625 HP Enterprise Dual Fuel engines at San Jose, Calif. handle the complete power load for all electrical and pumping requirements of this sewage plant.

"Trouble-free and maintenance-free, with very reasonable manpower requirements."

Fred M. Belick

Supt., San Jose, Calif., Sewage Treatment Plant

"We're extremely pleased with the record of efficiency and economy experienced to date with our three Enterprise Engines. They have operated trouble-free and maintenance-free, fitting in exceptionally well with our treatment plant requirements.

"By operating on methane, the sludge gas by-product of sewage treatment, our fuel costs have remained at a minimum. In addition, the Enterprise Dual Fuel 'Select-O-Matic'® feature has given us the flexibility we need when sludge gas production becomes erratic. On either gas or oil the engines respond well to changes in power demands. All in all, these engines provide us the dependable, continuous operation we need with very reasonable manpower requirements."

This and other model sewage plants in such cities as New York, East Boston, Mass., and San Diego, Calif., attest to the fact that complete dependability and economy of municipal operations start with Enterprise Engines.

Engines of Every Type and Size for Every Municipal Need

Enterprise specializes in engines for stationary and portable electric power generation, flood and water pumping systems, and sewage plant power. Versatile fueling is available in diesel, dual fuel and spark ignited gas engines. Models range from 73 to 7703 HP. Call in the Enterprise sales engineer in your area, or contact factory direct for information or help with your plans.

ENTERPRISE
dependable **ENGINES**

Over a million horsepower at work the world over!

ENTERPRISE ENGINE & MACHINERY CO.
Subsidiary of General Metals Corporation
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FRAM Water Separator and Fuel Filter Unit

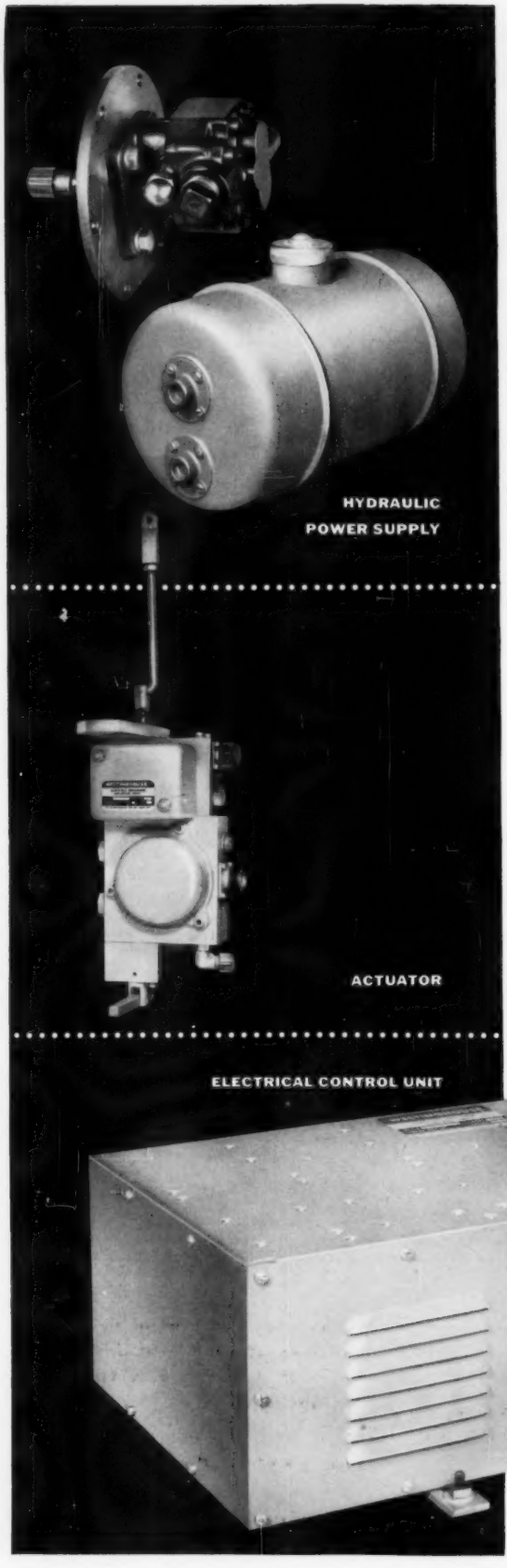
"dry-cleans" diesel fuel!

Both water and dirt are efficiently removed from your diesel fuel by the FRAM Water Separator and Fuel Filter Unit . . . fuel enters your engine *dry* of water, *clean* of dirt. That's why manufacturers, engineers and owners of diesel engines so often specify this FRAM Unit. They know it means longer life—less wear—fewer repairs. Get the most from your diesel—always insist on FRAM protection.

FRAM®
OIL • AIR • FUEL • WATER
FILTERS

- 100% water removal from Diesel and other fuels.
- Dirt and other contaminants down to one micron (.000039") removed.
- Combination unit fits all Diesel engines 225 H.P. and under, and up to 100 GPH flow requirement.
- Cuts injector maintenance costs. Reduces down time.

FRAM Corporation, Providence 16, R.I. • Fram Canada Ltd., Stratford, Ont.



Opening the way to new engine control accuracy

Westinghouse electric governors actually predict speed changes . . . react faster than any other

Now, Westinghouse offers the fastest acting electric governor in history. It senses electrical load change . . . anticipates speed change. It is much faster acting than the conventional governor which must wait for actual speed change.

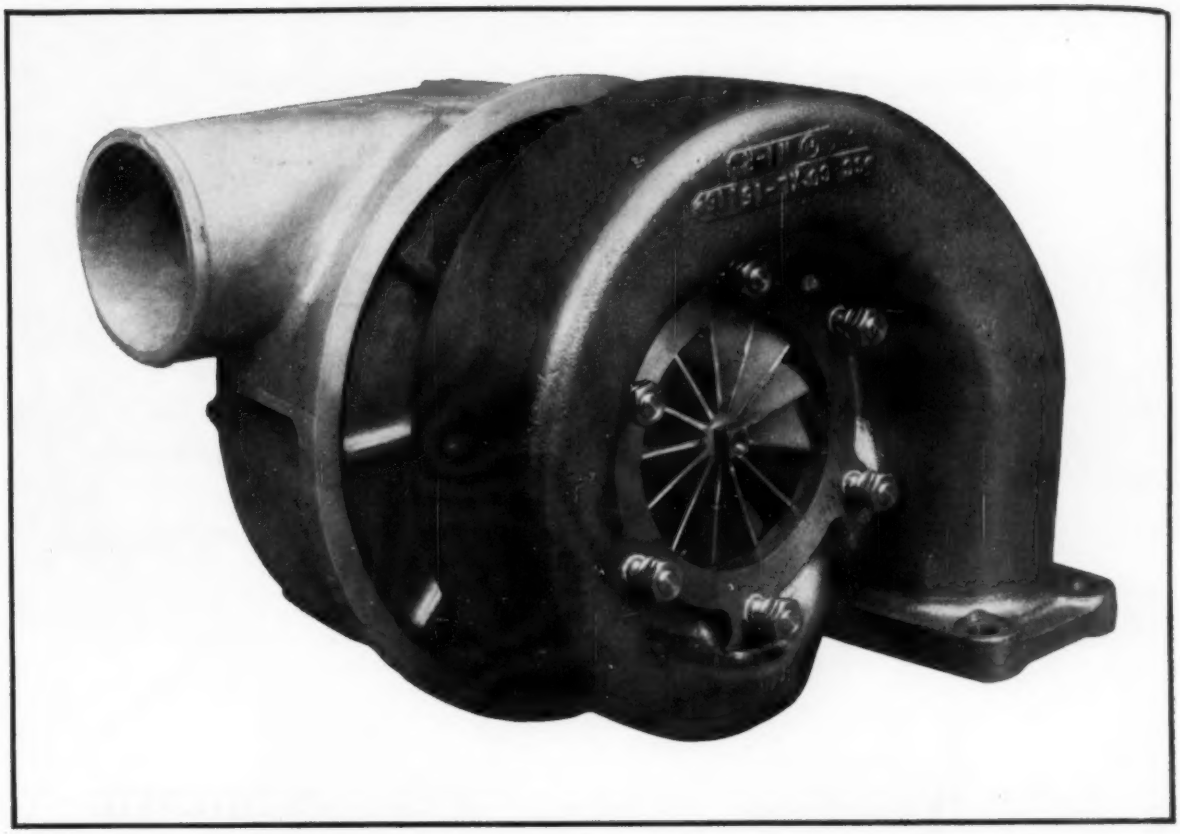
The Westinghouse electric governor also provides for automatic isochronous load sharing by two or more engine-generator sets. Electric frequency (speed) sensing, another prime feature in the Westinghouse electric governor, eliminates the need for expensive and troublesome mechanical speed-drive systems.

This accurate, dependable governor is easy to maintain . . . no tubes or other frail parts . . . operator attention is cut to minimum.

FOR ALL THE FACTS, write Westinghouse Electric Corporation, 3 Gateway Center, Pittsburgh 30, Pennsylvania. Ask for J-22045.

YOU CAN BE SURE... IF IT'S

Westinghouse



Ni-Resist inlet casings help Schwitzer provide more miles of turbocharged power for diesel operators

Wringing extra power out of exhaust gas takes a special material – one that resists heat, keeps its strength at high temperatures. That's why the Schwitzer Corporation's turbocharger has a Ni-Resist* high nickel cast iron inlet casing – the part that harnesses exhaust gas.

With type 2b Ni-Resist casings Schwitzer can assure you of more trouble-free miles with extra horsepower and greater fuel economy, on the highway or on the job.

Ni-Resist high-nickel austenitic cast irons provide basic properties needed

- *Strength and fatigue resistance at today's operating temperatures.*
- *Corrosion resistance for high temperature exhaust gas.*
- *Resistance to cracking and warping during the heating and cooling of normal operation.*

Biggest bonus of all is the way Ni-Resist alloy irons solve the problem of scale. The expander wheel (above) spins at 40,000 to 50,000 rpm. At such speeds, loose scale particles could easily damage the whole unit.

Ni-Resist irons resist scaling, prevent flake-off.

Get to know more about the Ni-Resist alloy irons. In manifolds, piston inserts and valve guides – wherever a cast part needs stability up to 1400°F. . . . corrosion and wear resistance . . . minimum warpage and galling – Ni-Resist irons provide the most practical answer.

For full information fill out the coupon and mail.

*Registered trademark

The International Nickel Company, Inc.
67 Wall Street, New York 5, N. Y.

Please send me a copy of "The Cast Material That Made Turbocharging Practical."

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Company_____

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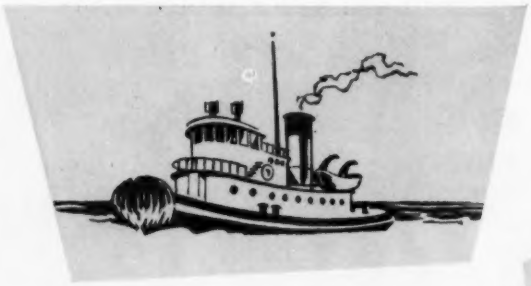
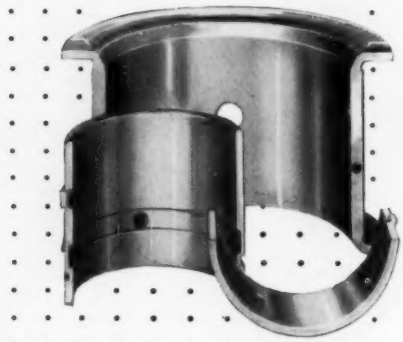
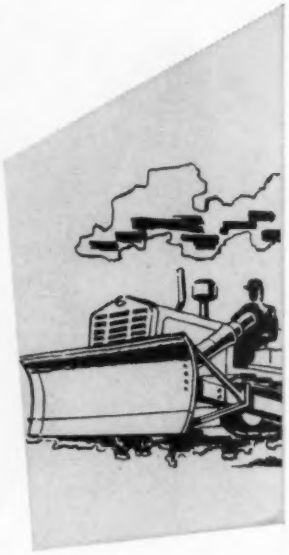
INCO TRADE MARK THE INTERNATIONAL NICKEL COMPANY, INC. 67 Wall Street New York 5, N.Y.



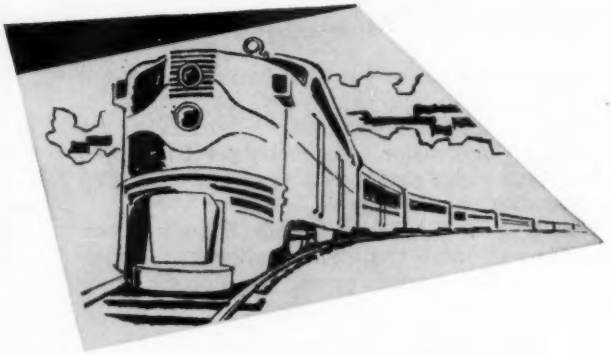




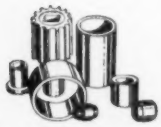
Higher Horsepower Demands the Greater Strength of JOHNSON Aluminum on Steel BEARINGS

With the trend in diesel engines toward ever higher horsepower, the permanently bonded aluminum on steel bearings developed by Johnson Bronze rapidly are becoming standard for heavy diesels. Designed to take loads as high as 5000 psi, they are ideal for heavy-duty, high-speed engines.

Johnson Bronze pioneered in the development of aluminum on steel bearings, and today is a leading supplier. We can furnish a wide range of plain or flanged, full or half bearings, with or without precision overlay. Take advantage of our years of experience and special production facilities—your Johnson Bronze representative will be glad to give you full details on how Johnson aluminum on steel bearings can improve your engine's performance. Johnson Bronze, 470 S. Mill Street, New Castle, Pa.



JOHNSON Bearings



POWDER METALLURGY—BRONZE OR IRON

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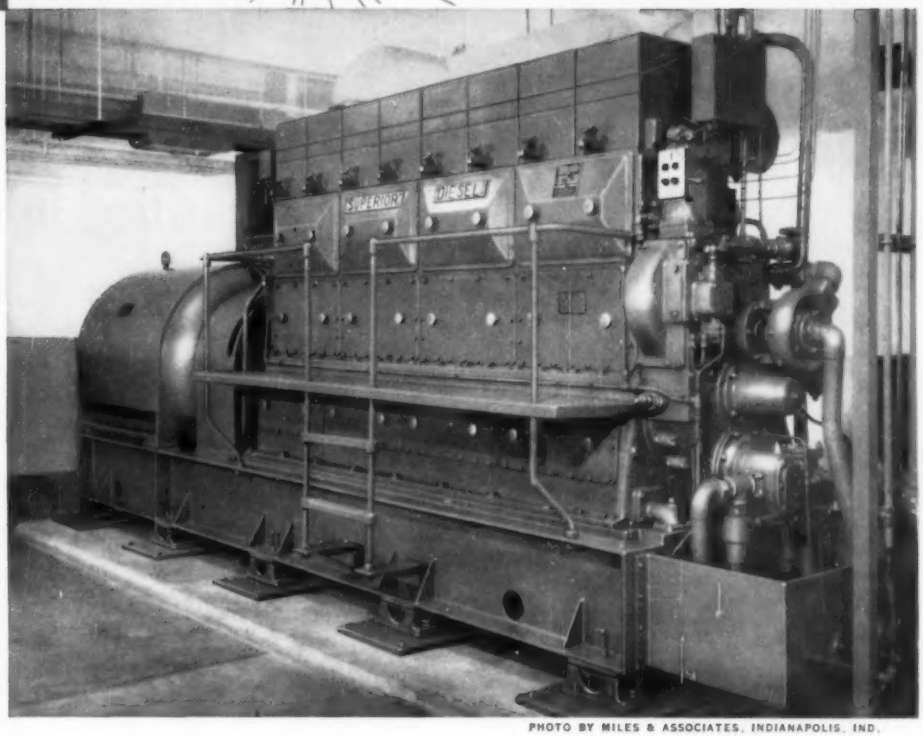
BRONZE—CAST OR ROLLED

Mid-west telephone company

Dials D for DEPENDABLE DIESEL



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...gets WHITE SUPERIOR POWER!

Anytime, anywhere you call on White Superior Diesels for generator power, they answer—instantly, powerfully, dependably. A mid-west telephone company wanted standby service they could absolutely trust. So to power three heavy-duty electric generators, they wisely chose Model 40 Superior Diesels, just as hundreds have done on generator applications throughout the world.

Singly or in multiples, these compact, completely self-contained Superior power packages economically supply prime power, supplementary or standby power. Superiors consistently produce high output for size, and they can operate continuously on non-premium fuels.

Superior's dependability begins with an engine of extreme design simplicity. Fewer cylinders and internal parts furnish power equal to other engines with more cylinders. Such simplicity contributes to fewer replacements, lower maintenance and most important, longer life.

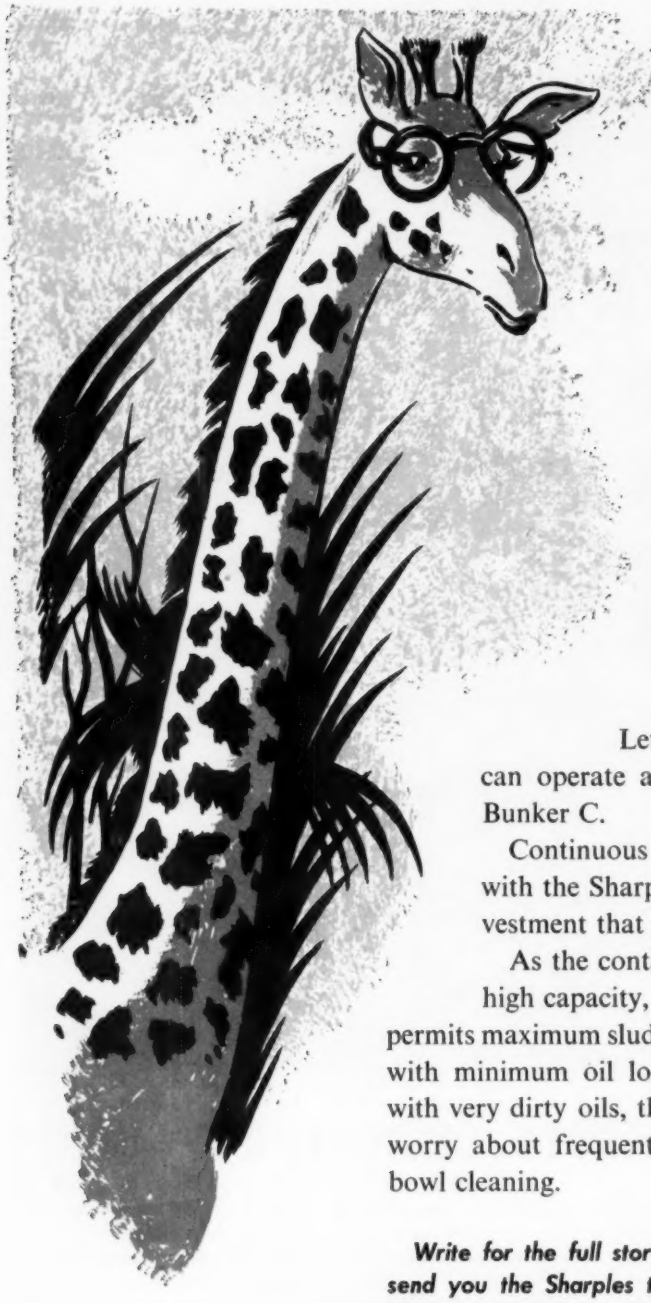
Standard or custom-built sets meet all NEMA and AIEE specifications, and are available in the power range from 150 to 1500 KW. *Write today for complete information.*

Superior ENGINES · ATLAS IMPERIAL DIESEL ENGINES · White DIESEL

White Diesel

WHITE DIESEL ENGINE DIVISION
THE WHITE MOTOR COMPANY

Plant and General Offices: Springfield, Ohio



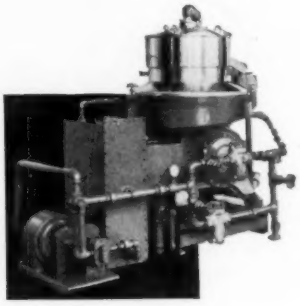
It'll pay you to take a LONG LOOK *at the* SAVINGS...

Burn BUNKER C purified in a Sharples Centrifuge

Let Sharples show you how your diesels can operate at *extra savings* by burning low cost Bunker C.

Continuous purification of residual oils is assured with the Sharples self-cleaning Nozljector . . . an investment that pays its own way right from the start.

As the contaminants are continuously removed at high capacity, a special recycle permits maximum sludge concentration with minimum oil losses. Thus, even with very dirty oils, there's no need to worry about frequent shut-downs for bowl cleaning.



Write for the full story today. We'll gladly send you the Sharples technical report, "The Sharples Centrifuge and Residual Fuels for Diesel Engines."

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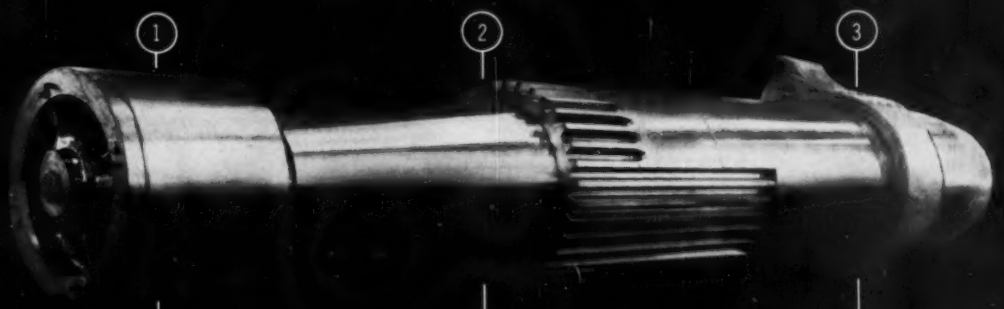
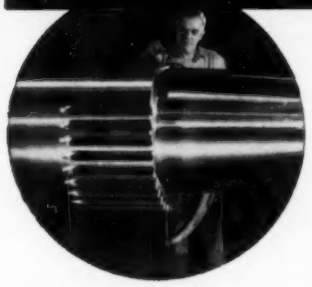
ERIE FORGE & STEEL!

Complete Forged and Cast Steel Assembly
for Electric Furnace Roof Lifting Ram . . .



1. Cast Steel Roof Lifting Piston Head Gland Ring and Cap Assembly 2990 pounds.
2. 55,700 pound forged alloy steel Roof Lifting Ram.
3. Cast steel roof ram buttress 3880 pounds.



This roof lifting ram used by a leading builder of electric melting furnaces was manufactured and assembled complete by Erie Forge & Steel Corporation. The steel castings were poured in our own steel foundries. The steel for the forging was made and forged in our own shops. These components were machined, keyways finished, and the whole assembled within our own plants here in Erie.

Close metallurgical control of every step in foundries and forge shops results in unquestioned quality . . . quality which is responsible for the wide diversity of castings and forgings for Diesel Locomotives, Maritime Vessels, Hydraulic Presses, Steam Hammers, Cement Mills, Steam Turbines made here under "One Responsibility and One Control from raw materials to finished product." Place your component parts requirements with us, confident of the results you expect.

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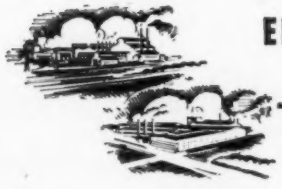

ERIE FORGE & STEEL CORPORATION

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AiResearch Turbochargers make your diesels run cooler!

Factors like advanced wheel design and perfectly matched turbine and compressor keep engine thermal loading at a minimum

So effective is the AiResearch turbocharger that it provides power gains while actually lowering the heat level of the engine.

Ambient air is compressed with an efficiency as high as 82%, feeding a maximum weight of air into the cylinders at the lowest possible temperature.

Results: maximum power gain at minimum fuel cost; complete combustion with elimination of objectionable smoking; low engine thermal loading insuring long, trouble-free operation.

All AiResearch turbochargers are air cooled, placing no added burden on the diesel cooling system and requiring no complicated plumbing. The rotating assembly is removable as a unit, simplifying in-the-field maintenance. This advanced design evolved from the most extensive experience in the field of small turbomachinery in America.

Your inquiries are invited.

BASIC SPECIFICATIONS FOR AIRESEARCH TURBOCHARGERS

MODEL	F-51	C-60	A-60	E-100	B-100
Diameter — in. nom.	10	11.5	15.25	15.1	15.4
Length — in.	10.5	12.9	16.75	14.7	17.1
Weight — lb.	40	95	125	112	135
Output — lb/min. (Standard Conditions)	29-51	30-60	38-60	50-100	60-100

THE GARRETT CORPORATION

AiResearch Industrial Division

9225 South Aviation Blvd., Los Angeles 45, California

DESIGNERS AND MANUFACTURERS OF TURBOCHARGERS AND SPECIALIZED INDUSTRIAL PRODUCTS

NORDBERG

"standby" Diesel increases steam plant efficiency . . . cuts operating costs

HERE in Woodstock, Illinois, residential customers and industry alike depend solely on the municipal plant for power. "*It's a big responsibility*," states William H. Day, City Manager at Woodstock, "*and the principal reason why this city recently diversified its power generating equipment.*" Now on the line, in a plant previously powered by three steam turbines, is a 3660 hp, 2610 kw Nordberg *Supairthermal*® Duafuel engine. Its addition increased plant capacity to 16,610 kw . . . more than double peak demand.

The Nordberg engine was purchased as a standby unit to quickly supply the total residential power needs in case of boiler or turbine failure and to handle peak load conditions. The new *Supairthermal* engine has fulfilled all these needs and more . . . it has demonstrated its dependability and economy to such an extent that it has become a base load unit during the summer months. It generates about 10 per cent of the monthly production of over three million kwh, and is helping to lower costs of the entire power plant operation.

Woodstock's experience is added proof of the ability of Nordberg engines to provide reliable, low cost power for municipal and industrial service. Write for information on Nordberg engines to meet your specific power requirements . . . in sizes to over 12,000 hp.

NORDBERG MANUFACTURING COMPANY, Milwaukee, Wisconsin

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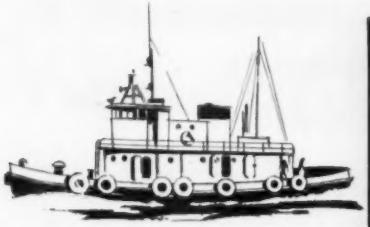
P-357

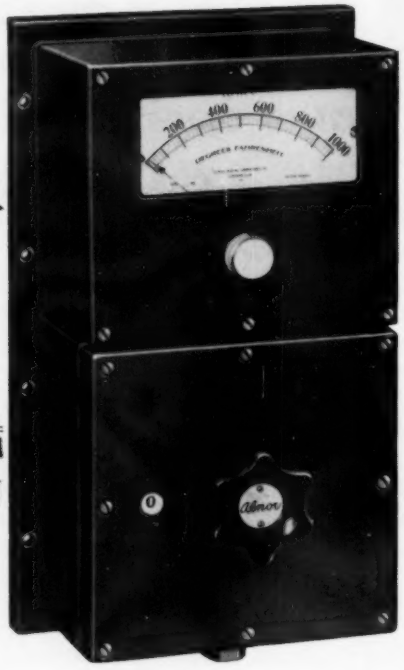
Plant Superintendent, S. L. Gunderson, (left) and operator, Karl Schacht, check operation of the versatile Nordberg 16-cylinder, V-type, 3660 hp Duafuel® engine installed in the Woodstock Light & Power Plant.

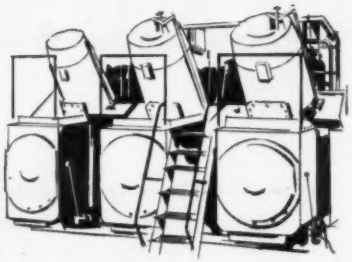
NORDBERG

DIESEL • DUAFUEL® AND SPARK-IGNITION GAS ENGINES

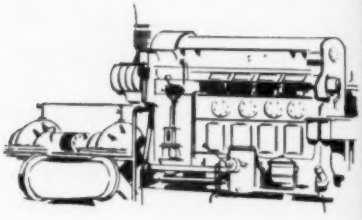


Marine

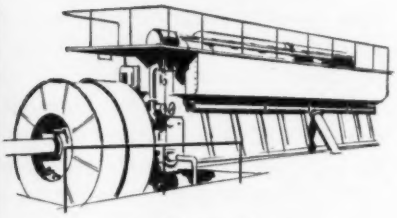




Engine compressor



Pumping



Stationary

GET THE BEST FROM THE POWER YOU BOUGHT...

WITH *Alnor*® PROTECTION

Accurate check of exhaust temperatures with an Alnor Pyrometer system can assure minimum fuel consumption per horsepower and long service from the power you bought—without the interruption of many common-cause breakdowns.

At a fraction of the cost of your present engine maintenance bill, an Alnor system can give you advanced warning of:

CYLINDER OVERLOAD **SCALED JACKETS** **DETONATION**
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Series A Pyrometers are designed specifically for direct mounting on diesel engines or other equipment subject to vibration and rough usage. Readings are accurate to within + or −1%. Dustproof, fumeproof, splashproof. Switch capacities of 4, 6, 8, 10, 12 and 16 circuits. Other models to 31 circuits. Get full information—by return mail. Send for Bulletin 4361 with complete details of the Pyrometer and thermocouple assembly designed for your engine.

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ILLINOIS TESTING LABORATORIES, INC.

Room 507, 420 No. LaSalle St., Chicago 10, Illinois

Engines for this fast new fireboat are protected by Purolator filters

Diesels on Baltimore's powerful new fireboat easily push it along at a snappy 17 mph while it discharges 12,000 gallons of water every minute. But if dirt brought in by even the cleanest fuel supply should ever get into the engines, this outstanding speed and power would quickly suffer . . . and expensive repairs would follow. That's why Purolator fuel and by-pass lube filters are included as original equipment on all engines in the ship.

It pays for you to use Purolator filters in your diesel lube systems, fuel lines and fuel injection system. And you can't improve on Purolator Micronic® filtration because the micronic element is made of plastic-impregnated cellulose which makes it waterproof, warp-proof and unaffected by engine temperatures or crankcase dilution. It filters particles so small they can be measured only in microns — .000039 inch.

Filtration For Every Known Fluid

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America's ONLY Guide To

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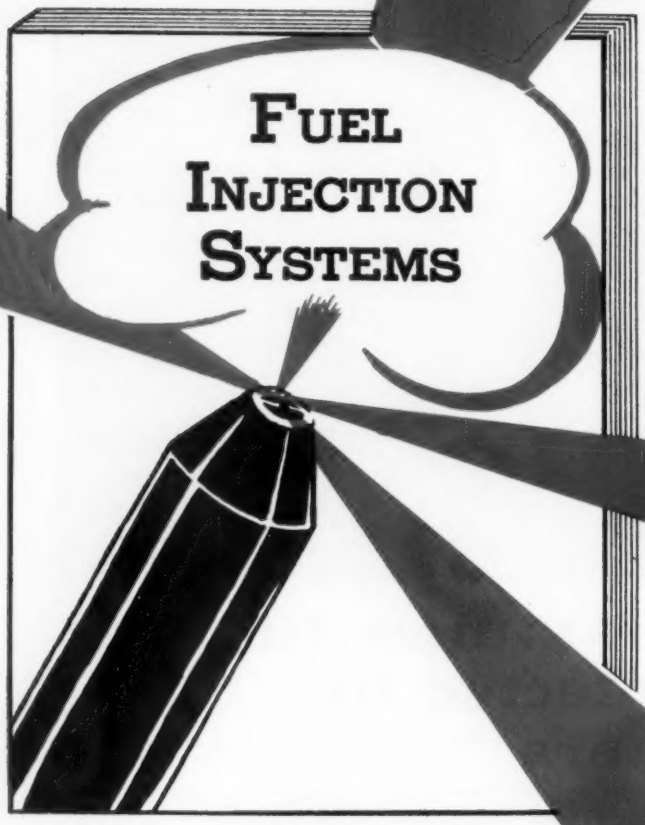
COMPLETELY REVISED, the brand *new* 220 page FUEL INJECTION SYSTEMS shop manual removes the mystery from injection systems design, maintenance, and operation—

describes the many dollar-saving injection repairs that can be performed by you—and those that should be executed only by your distributor or injection repair shop.



In its profit-packed chapters you'll find the principles of operation . . . details of construction . . . details of assembly and disassembly . . . test data . . . and preventive maintenance practices of injection equipment used on all American diesels:

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POPPING PRESSURE DATA—To enable you to test nozzles with the greatest efficiency, the FUEL INJECTION SYSTEMS shop manual contains an invaluable *directory of the most frequently used diesels' nozzle opening pressures—the only complete compilation of these figures available.*

Now in its Third Edition, the FUEL INJECTION SYSTEMS is read wherever diesels are built, serviced, or used. *Over 10,000 purchasers testify it is must reading for every diesel man—veteran or beginner.*

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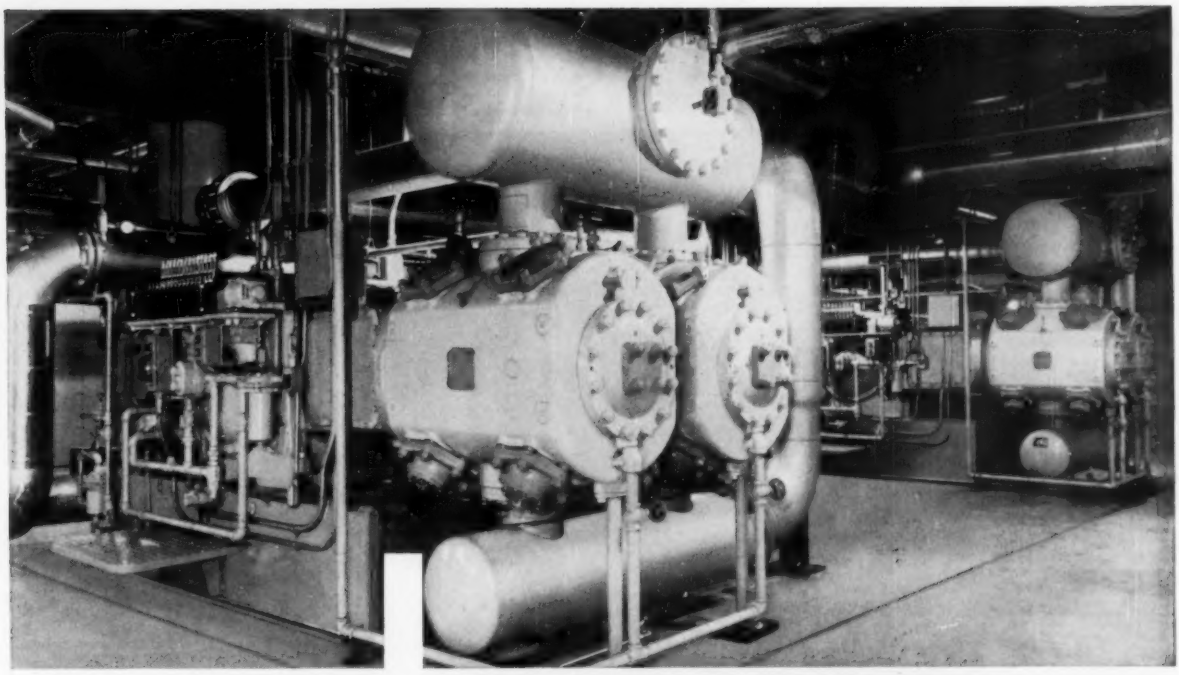
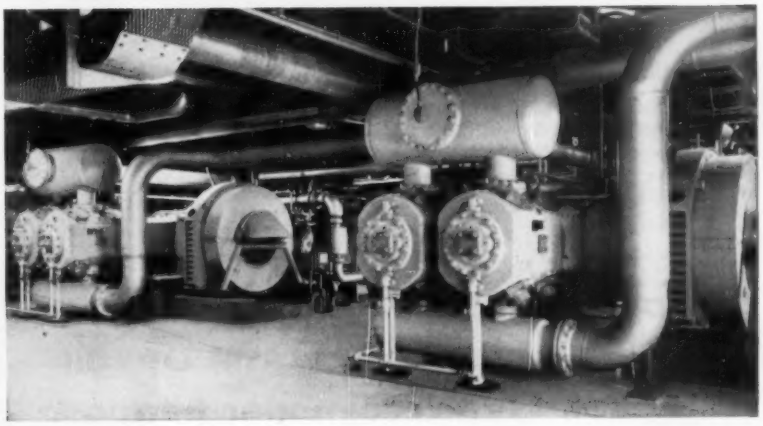


Four-cylinder Cooper-Bessemers, each rated 500 hp at 400 rpm . . . dependable source of compressed air to "blow down" boiler and lines in the El Segundo, California, steam station.



Another Example of Efficient Power at Lower Cost

COOPER BESSEMER EST. 1833

UP goes economy in a "blow down" operation ....with Cooper-Bessemer compressors

• In the El Segundo steam station of the Southern California Edison Company . . . Cooper-Bessemer 500 hp air compressors deliver the flexibility and reliability that cuts cost and trouble in soot blowing service.

Compressing air from atmosphere to 500 psig, these motor-driven Cooper-Bessemers are actuated automatically with continued "on-off" operation upon pressure demand.

The Cooper-Bessemer compactness feature makes these units ideal for limited space installation. Without any sacrifice of accessibility or ruggedness, you save on space, housing, installation and piping costs.

If *your* future plans include compressor service up to 6000 hp, make sure you check first with Cooper-Bessemer. Write today for additional information, outlining your particular requirements.

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New York City • Seattle, Wash. • Chicago, Ill. • Houston, Dallas, Greggton, Pampa and Odessa, Texas • Washington, D. C. Shreveport, La. • San Francisco, Los Angeles, Calif. • St. Louis, Mo. • Gloucester, Mass. • New Orleans, La. • Tulsa, Okla. Caracas, Venezuela • COOPER-BESSEMER OF CANADA, LTD., Edmonton and Calgary, Alberta, Canada.

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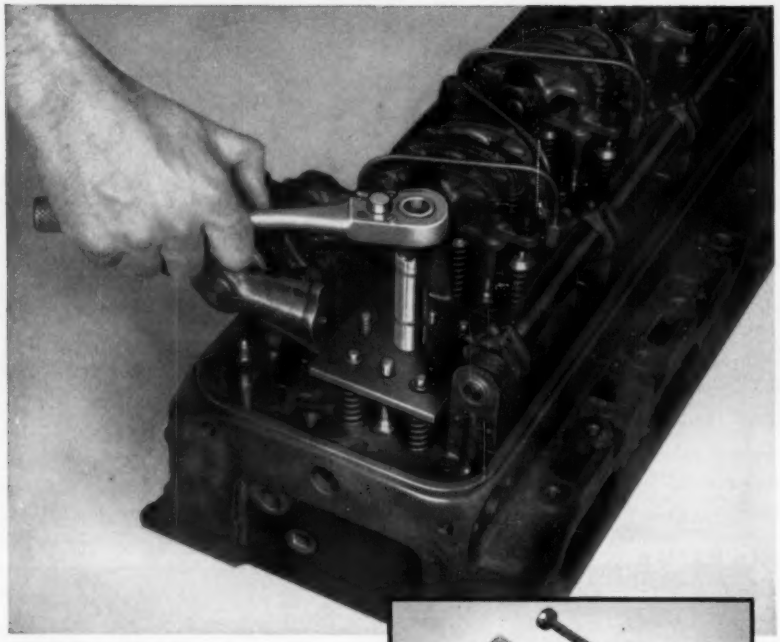
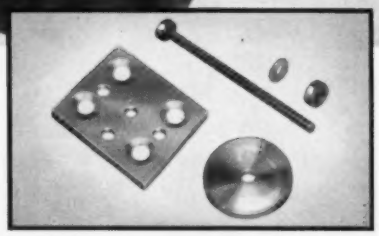
Eliminate "Boomerang" Jobs

TIPS
ON HOW TO CUT "DOWN TIME" AND COSTS WITH SPECIAL EQUIPMENT BY KENT-MOORE

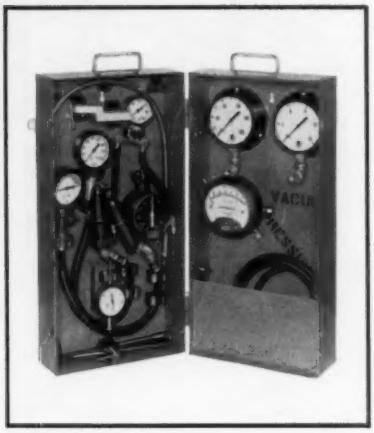




Compressing all four valves at the same time with this Kent-Moore Valve Spring Compressor, leaves both hands free to do a fast and efficient job.

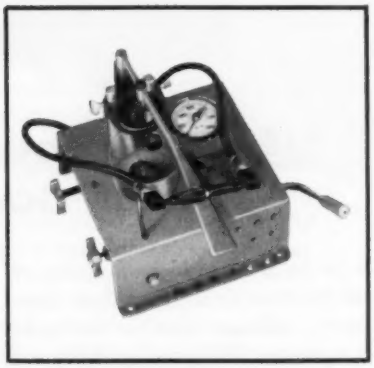
Now—tools for complete service maintenance of new GM Detroit Diesel 4-Valve cylinder heads

Consider, for a moment, the expense of "boomerang" jobs—those you figured completed but return with perhaps more extensive damage. Kent-Moore now offers six tools that deliver *complete* service maintenance on the new G.M. Detroit Diesel 4-valve head engines. Now you can perform all these jobs in your shop: (1) locate correct depth for gripping and removing hardened steel inserts, (2) insert valve seats without damage to cylinder heads or inserts, (3) automatically center your tool when driving guides from the cylinder block, (4) automatically position the guide into cylinder heads, insuring factory-type tolerances, (5) compress all four valves simultaneously to remove keepers, valve springs and caps—*with both hands free,* (6) check valve lash on hot or cold engines for factory-type adjustments. Tools are available for similar operations on the standard 2-valve head engines produced by G. M. Detroit Diesel.



J 4209-41 Diesel Diagnosis Test Kit

This kit saves you money twice. First by hunting down trouble *during check-up* before minor trouble causes expensive damage in the engine. Secondly, by helping you to speed up repairs by quickly locating the exact trouble. Easily check timing, compression, exhaust back pressure, engine RPM, blower intake, restriction, air box, oil and crankcase pressure, and cylinder liner position on all Series 71 and Model 6-110 GM Diesel Engines. Compact and portable, too.



J 7000 Injector Tester

This single Kent-Moore Rate-Maker tool performs all six tests specified for Series 51, 71 and 110 GM Diesel Engine Injectors. No special conversion units or individual holding fixtures to bother with. Sturdy 3000 pound gauge with "lazy hand" operation, micronic filter, adjustable popping handle, and other features combine to make this unit pay off fast in your shop.

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ENGINEERS AND MANUFACTURERS OF SPECIAL SERVICE TOOLS AND EQUIPMENT

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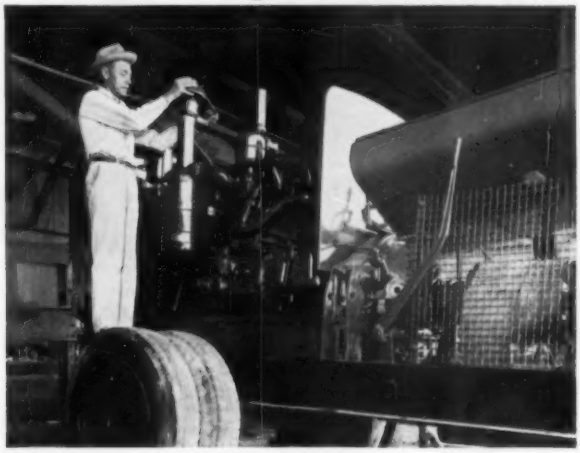
ENGINEER'S FIELD REPORT

PRODUCT RPM DELO OIL

FIRM M. M. SUNDT CONSTRUCTION CO. Tucson, Arizona

RPM DELO OIL ends 5 years of engine troubles

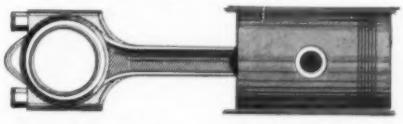
The pan has never been off the Caterpillar D7 engine of this Link-Belt Speeder shovel in 7 years, using RPM DELO Oil. Only repair was a single valve job—no other parts replaced. William Naumann, Sundt's Operations Manager, says, "We tried nine different major brands of oil in five years, trying to lick the frequent breakdowns that slowed our operations. Sometimes, main and rod bearings even froze solid on the crankshaft. We changed to RPM DELO Oil seven years ago, and, since then, have never had any engine troubles due to oil failure. We now use RPM DELO Oil exclusively in our 22 heavy-duty engines."



Lubricated with RPM DELO Oil, this Caterpillar D 13000 portable unit powered a rock crusher of M. M. Sundt Construction Co. for a total of 8976 hours before overhaul. "In spite of extremely dusty conditions the only time the engine was touched was to replace a head—no other repairs were necessary," reports master mechanic Billy Gray, shown replacing air cleaner on unit following overhaul.

Austin 101 rock crusher, powered by Caterpillar unit described above, works 20 hours a day at firm's materials stockpile outside Tucson. Company works year around on road paving, grading, foundations, building construction.

Why RPM DELO Oils reduce wear —prolong engine life



● Oil stays on engine parts—hot or cold, running or idle ● Anti-oxidant resists lacquer formation ● Detergent keeps parts clean ● Special compounds prevent corrosion of bearings ● Inhibitor resists crankcase foaming

LUBRICATING OILS RPM DELO

For More Information on this product contact your Standard Engineer or Representative, or write Standard Oil Company of California, 225 Bush Street, San Francisco 20, California

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the ERIE railroad uses PEDRICK FORMFLEX RINGS in Alco Diesel Engines

The FORMFLEX HO8 rings, which Erie has used for several years, provide greater conformability for more perfect cylinder seals. The results are minimum wear, less lube-oil consumption, long life, less lay-up for overhauls. Also, dependable performance helps keep trains on schedule.

PEDRICK PIONEERED
CONFORMABLE RINGS
FOR BIG-BORE ENGINES

Pedrick
PISTON RINGS

WILKENING MANUFACTURING CO., Philadelphia 42 and Toronto 2

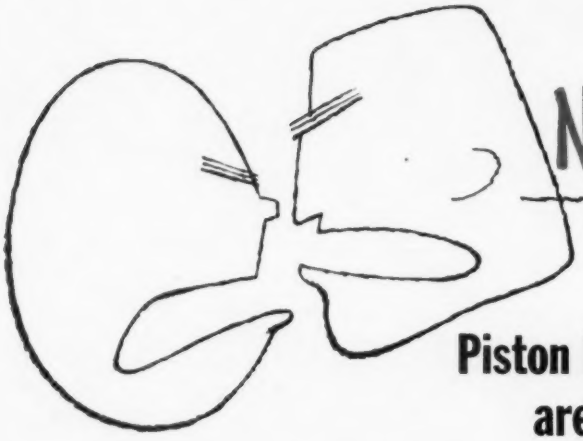
editorially speaking

Cutting Cost of Ownership

A lot of people are concentrating effort on reducing the user's cost of engine ownership. It figures; the power field is highly competitive. Since cost of ownership includes such items as initial cost, operating expense and maintenance cost, it is not surprising that there is more than one focus of this effort. Two conferences attended last month illustrate this point. The first was the Annual Conference of the Automotive Engine Rebuilders Association. Members from all over this country and Canada met at Detroit to discuss technical problems—and high-level discussion it was. The bulk of this membership is doing diesel work ranging from complete rebuilds to specialty work such as pin fitting, cam and crankshaft regrinding. Two strong impressions came through. Here was a group of specialists applying a high level of technical knowhow on one important phase affecting cost of ownership. Secondly, they were backed up by the tool industry that provides flexible, productive and high-precision tooling to enable them to do a better job faster. Rebuilders buy them too. Check some of their shops; they're a credit to the industry. And since this is a highly competitive field (and also one subject to warranty claims) the work must be done fast and right. All this helps reduce maintenance costs and improves the acceptability of diesel power.

Now let's switch to the Oil and Gas Power Div., ASME, Conference. Here the focus is different. Here was evidence of the intensive research and development, both of engines and accessories, that produces today's more-economic, better-performing and longer-lived engines. More power from the same basic engine with attendant reductions in foundation, installation and structural costs, is holding down the user's initial costs and thus affecting cost of ownership. These are only two groups of many working in behalf of the user. Now let's hope that the user follows through. Keep those records, get that PM system working and take full advantage of the most efficient power producers today — the oil and gas engines.

B P E



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All components of Sealed Power Sleeve Assemblies for Diesels are factory matched for top performance. They are subject to rigid Sealed Power quality control throughout manufacturing.

Chrome plus Cyclan in Sealed Power Diesel rings means you positively defeat excessive heat, breakage, side wear, friction and corrosion. They break in fast—wear and wear.

These Sealed Power products assure the oil control and long life you require. Our engineers will welcome an opportunity to discuss their application to your problem. Please feel free to write.

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Leading Manufacturer of Automotive and Industrial Piston Rings Since 1911

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highlights

Union Pacific will use an electronic brain for inventory control, payroll computation and other accounting work. The huge unit will occupy one entire floor of the 5-story addition to the railroad's general office building in Omaha.

A-C's contribution to DEW line defenses is cited in their excellent booklet "Engineering in Action". Buda-driven 100-kw generator sets with a bulk of A-C electrical components were supplied for western portion; 170-kw units for eastern segment.

Esso has reduced heavy fuel oil prices ranging from 6 to 11 cents a barrel. Reductions are in effect along the Atlantic Coast from Charleston, S. C. to Maine.

Mack resorts to radio to air the many ways trucks serve the nation. On June 28 the trucking series will be heard on NBC's Monitor each Friday, Saturday and Sunday through September 1. An informed public is a friendly public. That's the reason behind this educational program produced in cooperation with the ATA Foundation.

There are oil men and there are oil women. And the women in the petroleum field aren't marking time. "Progress Through Education" is the goal they will explore when the Association of Desk and Derrick Clubs meet in Chicago on August 30-31. There are 117 local clubs here and in Canada. More power to the distaff side!

Accent at PIE is on reducing accident rate. Besides awards for improvement, they accent the negative, too. The "White Elephant" is bagged by the Pacific Intermountain Express district with the worse accident rate. The "8-Ball Trophy" goes to the supervisor whose men had the biggest injury rate. Since awards—good or bad—must be displayed, PIE reports the system serves well as a safety booster.

No more steam locomotives will be built for British railroads after early next year. By then, the 151 steam engines on order will be completed. No more orders will be placed. Sir Brian Robertson, head of state-owned railways, announced this in a progress report on their well over $3 billion 15-year modernizing program. Longer runs, greater annual mileage and less wear on railbeds are reasons he cites for turning to diesels.

Electro-Motive Division, GM, reports a total of 29 diesel-electric drill rig sets in the works with 18 already in service in the hands of 16 customers. This involves a total of 67 SR8 power units.

Latest box score on Class I locomotives shows diesel-electrics with 747 on order and none on order for either steam or electric units. These figures, just released by Association of American Railroads, record 26,518 diesel-electrics owned. Steam locomotives lag behind with a 3389 total, and electric units are almost out of the running with only 607 locomotives.

Diesels power the refitted "garage ship", Italterra, ferrying 1000 Fiats on her maiden voyage to this country from Italy. The 10,000-ton Liberty Ship's conversion cost a little more than $200,000 for complete engine replacements and structural adaptations.

Allis-Chalmers sales scored an all peace-time high at the end of the first quarter in 1957. Backlog of orders reached $250 million and the tone of business is good, says R. S. Stevenson, A-C president. Sales of farm machinery are running ahead of the same period last year. Still lagging are construction equipment sales reflecting slow start of road programs. Latest figures indicate this jam may now be breaking up.

"Piggyback" traffic is growing. In 1954, when the B & O started its trailer-on-flat-car operation, just six cities benefited by such service. Now there are 15 cities in the company's TOFCEE network. Besides they have a substantial interline trailer service connecting the B & O with other west and southwest railroads. Latest innovation is mechanically refrigerated trailers for shipment of perishables.

Bidding for 3555 miles of roads is in process. These contracts call for $465 million in federal funds. Other data released by ARBA states 16,394 miles of roads requiring $1.5 billion in federal monies have advanced to the "programming" stage. Under actual construction are 19,451 miles of highways, involving $1.8 billion federal funds. On the gloomier side, almost an equal amount—$1.7 billion—remains in reserve for road building projects not yet programmed.

Talking Shops

Every shop is different. Scope and type of work done, needs of the area served, building layout, tooling, and perhaps most important, the ideas behind the operation are all influencing factors. That's why DIESEL POWER continues its shop interviews. Here are more ideas for you.

EVER see an engine rebuilding and fuel injection repair shop with a polished wooden floor? Walk into the rebuilding section of Northern American Engines Company and your first thought will be that it's a sales display of all the different machine tools. But it's a working shop.

Actually, it's two shops and two companies—North American Engines Company and North American Diesel Injection Company—both in the same building and run as a joint enterprise. Adam Talacki heads up the engine rebuilding and Ed Smith, the fuel injection sales and service.

This building on "B" Street, Philadelphia, was acquired last year and operations started here about the first of the year. Machinery was cleaned and painted as it was moved from the former location. Fact is that moving is not fully complete since the problem was to make the switch without curtailing operations.

The move solved the major problem of most shops—space. Here's the first idea to stick in your hat when planning a shop—get the space for tomorrow as well as for today. They've got it now but it took a lot of time and money including an expensive move to provide the space for expansion.

Now we'll get to some specific questions. Engine work will be covered first with Adam Talacki supplying the answers.

"Adam, what was your plan when you set up the shop?"

"No different than before the move but this time we had more space and better facilities. We have never gone in for "straight-line" production rebuilding. For one thing, about half of our work is for original equipment manufacturers. This involves operations like crankshaft grinding, cam grinding, head and block grinding, flywheel grinding, pin fitting, and head rebuilding.

"Add to this the number of similar jobs done for engine rebuilds and you can see that the bulk of the work is of the machine shop type. This doesn't lend itself to production lines. We set aside some bays for rebuilding and all reconditioned parts are brought to them for assembly."

"Doesn't this create a handling problem?"

"We don't think so. Say that you are bringing in an engine for rebuilding. You bring your truck in the driveway on the side of the building. Near the rear is the main entrance. The monorail extends out over the truck and we lift the engine out, carry it to the cleaning room at the rear, strip and clean it.

"The monorail lets you carry all the parts right to the machine where work is to be done. When it's finished, you can get your heavy lifts right to the assembly bay in the same way. The assemblers then have their own hoists for handling large components. When assembled, engines are taken back to the rear of the building for test and painting. Then they are handy to the entrance for loading and shipping."

"Then you considered all this when you set up the tools?"

"In general, yes. Building layout is bound to have some effect. Even here on the ground floor you have to figure on weight distribution. Then there are always the matters of spacing, interferance, etc. We've tried to keep long lifts of heavy items to a minimum. For example, the furthest machine from the entrance-exit is the cam grinder. The camshafts are light enough to manhandle. This illustrates the general idea that we tried to follow."

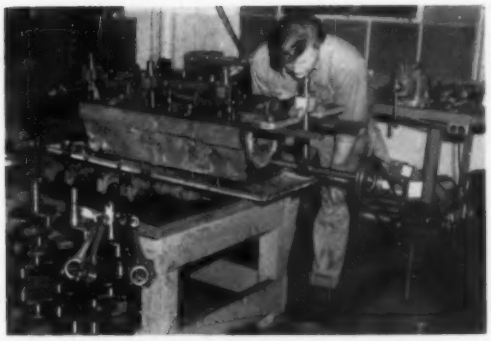
"Now let's get some of your ideas on different operations. Cleaning, for instance."

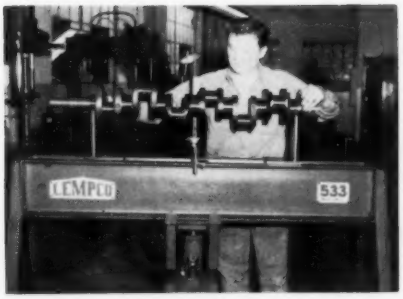
"Cleaning is a state of mind. We made up our minds when we got this place that we'd keep it clean. All parts are cleaned thoroughly before they get out of the cleaning room into the shop. Machine operators have to keep their machines and the space around them clean. We have someone in every week to polish the floors. The men seem to appreciate it and cooperate.

"As for the mechanics of cleaning parts, we have one big hot-tank. We use an inhibited alkaline cleaner. We like this particular material for its general performance and its gentleness on bearing materials such as babbitt. Soaking is followed by a thorough water rinse."

Parts are cleaned by soaking in a hot alkaline solution followed by thorough rinsing.

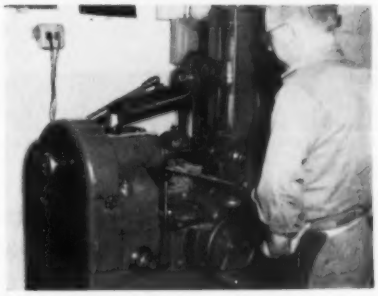
Line boring camshaft bushings. Same bar is used for aligning main bearing saddles.

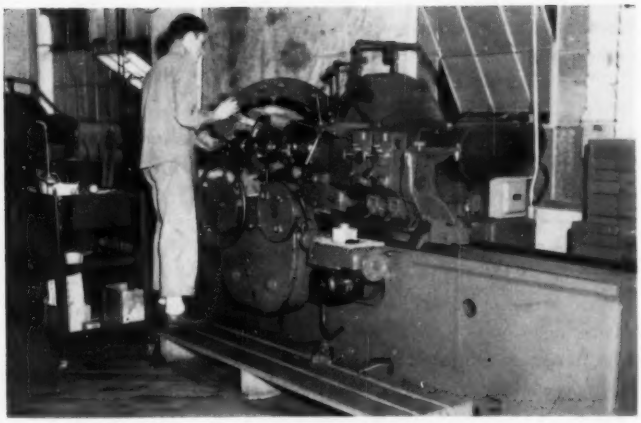




Hydraulic jack supplies power for shaft straightener. Dial indicator checks for proper shaft runout.

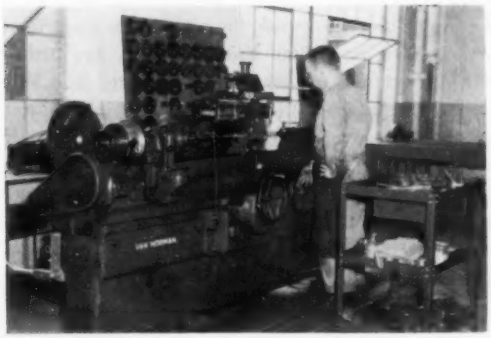
Con rod bores are finished true, parallel and with proper center-to-center distance. Comparator tool setting precision fits pins to both rod bushing and piston.





Following complete regrind, crankshaft bearing surfaces are polished by high-velocity, mildly abrasive belt.

Surface grinder's roll-over feature speeds inspection.



Cam grinder duplicates factory contours. Note master cams on backboard for different makes.

Simple wooden fixture holds head at convenient height for reconditioning operations.

"Since you have so much machine work, let's have your procedures on some of these jobs, how about crankshaft grinding?"

"As you see, we have two grinders. They have the same swing (24-in.) but one has an extended bed to handle up to 120-in. shafts. The other takes an 84-in. shaft. The most critical part of the whole job is preparation.

"We give each shaft two checks for straightness. The first is made on a lathe. We check to get zero runout on unworn portions such as flanges, gear seats, etc., and set up accurate centers. Then we can check intermediate mains. If straightening is indicated, we use a hydraulic machine built for this.

"We get a second and more accurate indication on the grinder itself. With the shaft set for zero runout at both ends, we again check our mains. We may "kiss" them with the wheel to be sure that we are checking runout and not wear. We use the Arnold gauge in this final check before grinding and, of course, during grinding. We take . . ."

"Hold it. What about magnetic inspection?"

"You forget; Magnaflux is just up the street. We had a machine and sold it. We prefer to let them do it and get their certification."

"Okay, get back to grinding."

"The grinding is actually pretty routine. The boys that run these machines really know how. We might talk about fillets; we're fussy about these. Notice that we have a supply of grinding wheels, each dressed on both edges to a particular fillet radius. We reproduce the manufacturer's specs.

"All journals and cranks are polished. We use the high-velocity abrasive belts. Shafts are left 0.0002 to 0.0003-in. over and brought to size in the polishing operation. Incidentally, this method of polishing also does a good job of blending in the oil holes."

"Now, let's talk about camshaft grinding."

"Well, the first thing is that since we got the machine we've had all the work that we could handle. You can see from all the cam masters on that backboard that we grind a good many different kinds of shafts. If we get a new make, it's a cinch to grind the masters and duplicate the manufacturer's cam contours."

"Granting that the cams brought in for grinding need it, how about the camshafts in your rebuilds?"

"We do it automatically on rebuilds and they all can stand work. Naturally, some are worse than others, in fact, we reject some. Accuracy of cam indexing can nearly always be improved and in a few cases a light truing grind will correct wear. In some, the wear is bad and we have to give them a full grind, including the journals."

"Yet we keep hearing that camshafts don't wear."

"They didn't wear for us either when we had no way to check them and the only alternative was to buy a new shaft. We really knew better but we had to compromise. Now we can correct the condition for a good deal less than the cost of a new camshaft. Since correct valve operation is so important for best engine performance, it's a real service to engine owners.

"Journals wear too. We regrind them along with the cams. A good indication of the acceptance of camshaft grinding is that most engine builders are now making 0.010, 0.020 and 0.030-in. undersize bushings available.

"I'd like to make a point on grinding journals. It's not as easy as it looks. The camshaft center line should coincide with the centers of all journals and the base circles of the cams. We've gotten in some camshafts lately with reground journals. The cams weren't touched. The three journals were all straight and in line but not the cams. Either the shaft had a whip in it or they centered on a worn area.

"As a result the surface of the center journal was ground around a new center. But the cams on each side are not on this center. This changes the lift and the base circle wobbles. In one case where hydraulic lifters were used, the base circle wobble was enough to pump up the hydraulic lifters and cause valve trouble."

"Suppose that we get to rebuilding now."

"Okay, most of the specialized jobs would be the same whether we were doing it as a separate job for a customer or for our assemblers. Let's start with this block. We mike up the bearing bores and also check them for alignment with a boring bar. If they have to be trued up, we face off the caps, torque them down and set the bar to take the minimum cut on the block side.

"We also mike up and check alignment on the camshaft bushings. When the shaft journals have been ground we put in the right undersized bushings. With some of the stiffer blocks there is no need for line boring but in others we do it as a matter of course.

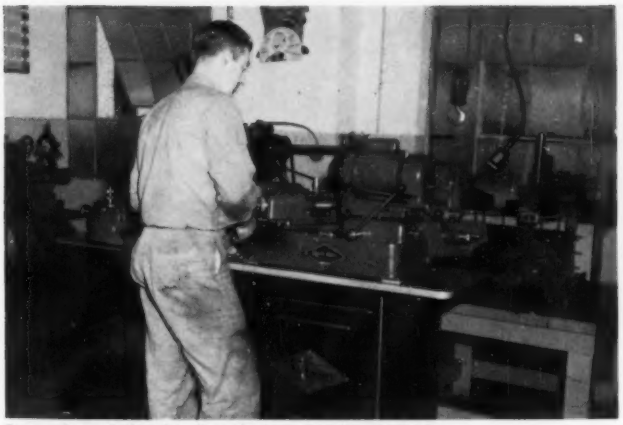
"The top of the block is checked for straightness. If they are out more than 0.004-in. we reface them.

"Where dry liners are used, we mike up the block bores. When necessary, we hone them straight and round, using new liners with an oversized OD. With wet liners, the flange counterbore and the lower sealing surface get a good check. We can correct any bad conditions with one of our cylinder boring bars."

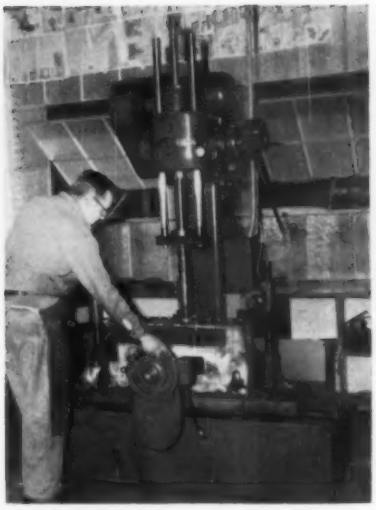
"Since you have a honing machine, do you hone the ID of liners?"

"No. We might use it to break the glaze on a good used liner or to get a particular finish. If you go further than that you get into oversize pistons. I'll tell you how we feel on this because it affects both our procedures and the tools that we have bought.

"When an engine is pulled out of a truck or boat for rebuilding, we think you should go all the way and bring it back to standard where possible. We replace most of the wearing parts. All bearings, bushings and seals are replaced. New liners with standard ID's (and OD's when



Two valve grinders handle refacing of valves and also have fixtures for truing up tappets and rocker arms.



Cylinder hone sizes and gives proper surface finish to bores or cylinder liners that are to be reused.

possible) are used. We prefer to use finished pistons, tin-plated where applicable, and with aluminum pistons, those with Ni-Resist inserts.

"Sure, we have a piston grinder but it's used only when for some good reason we can't stick with standard items. The 'Pin Shops', that's a different story. We fit a lot of piston pins and with today's close tolerances we like the precision and finish we get by the 'comparison' method of sizing the hole from the pin that's to fit it."

"How about cylinder heads?"

"They are a big part of our work; we do a lot of big heads as well as those for automotive-size engines. Here again we feel that most parts should be replaced. We use new valves and springs, usually replace the guides and take a long, hard look at the inserts before reusing them. All heads are run through the surface grinder. It's good insurance and unless warpage is really bad, not enough metal is removed to worry about."

"Does each assembler stay with the job all the way?"

"Yes. While they are good men and can run the machines if necessary, we keep certain men on certain machines and they feed finished items to the assembler. He puts the whole thing together and is responsible. He has a full set of tools, including torque wrenches, to do the job right."

"What about testing?"

"Now you've got me. We have a dynamometer but you'll have to remember that we moved recently. It's still set up at the old place and we haven't had time to move it here. We have to block test the engines, using test instruments, until we set it up here. Come back next month."

The building has two floors, the second also being designed for heavy loading. An elevator provides for heavy lifts. North American Diesel Injection Company occupies this floor. There are their different department shops, the stock room, offices and space left over. This area will be used for display space when a line of diesels is taken on and for storage as required. Now, we'll talk to Ed Smith who heads up the fuel injection sales and service operation.

"Ed, just how are you set up?"

"First, we are franchised by American Bosch, Hartford Machine Screw (RoosaMaster), Robert Bosch and Demco. We also handle Stark's rebuilt cylinder heads, Hydramotive, Inc., hydraulic starters and Spray starting products.

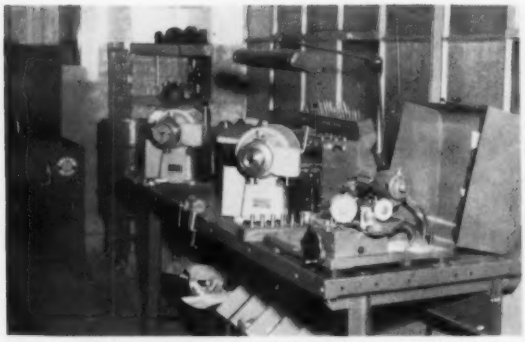
"In addition to the work that we do for the rebuilding operation, we do a lot of work for other accounts. These include a railroad, several shipyards (Navy work included), and other types of commercial accounts. In addition to the injection pumps and nozzles, we do a lot of governor repair. We have the railroad-type test stand for testing and adjustment of the various hydraulic governors.

"I see that you have different departments. What is your work flow?"

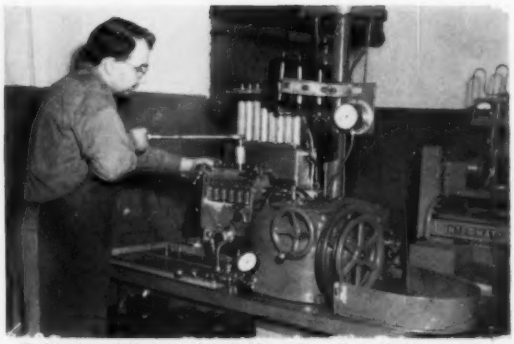
"Let's take a pump that comes in for complete overhaul and calibration. It goes to the cleaning room for teardown and thorough cleaning. Of course, all parts are kept together. When clean . . ."

"Whoa. Let's talk about the cleaning."

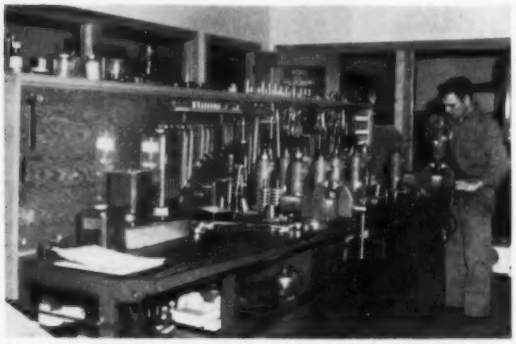
"Well, we have the tanks you see there. We use a cold immersion process. We've played around to get the solvent that we think best. The one that we use now is good and it does not affect cadmium plating such as you find



Lapping lathes, needle face grinder, arbors and other tools for injector seat reconditioning are conveniently grouped.

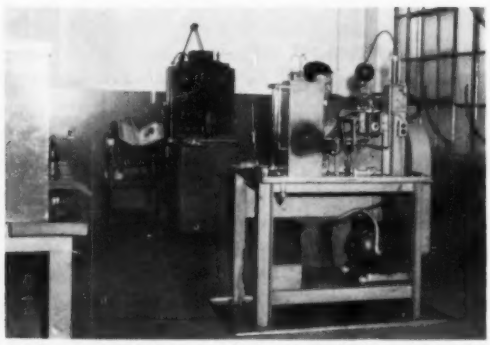


Tightening delivery valve holder after flow timing a pump during calibration. A second stand is in the background.

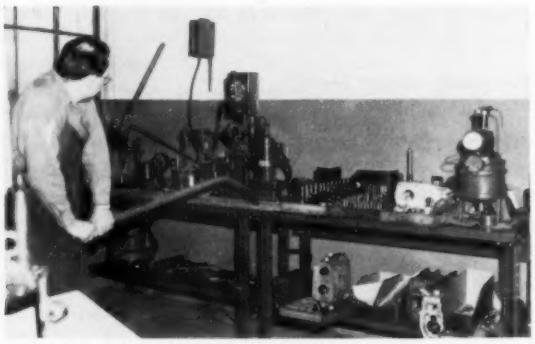


One of two back-to-back benches for assembly and disassembly of injection equipment and governors. Note handy tool board.

Cold soaking followed by an air-and-water rinse cleans all governor and injection equipment parts prior to reworking.



Back of calibration stand for individual-type injection pumps. Setup for governor testing is shown in background.



A variety of nozzle pop testers provide the proper capacity and all the fixtures for checking a wide range of injectors.

Major Tooling

Engine Rebuilding	
Crankshaft grinders	Van Norman Co.
Crankshaft straightener	Lempco Products, Inc.
Portable crank grinder	Sunnen Products Co.
Camshaft grinder	Van Norman Co.
Alignment boring bars	Cedar Rapids Engineering Co.
Valve and rocker refacers	Cedar Rapids Engineering Co.
Valve reseaters	Cedar Rapids Engineering Co.
Cylinder hone	Van Norman Co.
Utility hone	Sunnen Products Co.
Pin fitting machines	Van Norman Co.
Piston grinder	Van Norman Co.
Head and block grinder	Van Norman Co.
Flywheel grinder	Van Norman Co.
Hydraulic press	Lempco Products, Inc.
Lathe	South Bend Lathe Works
Dynamometer	Bennett Feragen, Inc.
Cleaning compound	Magnuson Products Corp.
Injection and Governor Service	
Calibration stand, multi-cylinder	American Bosch
Calibration stand, individual pump	Alco Products, Inc.
Calibration stand	International Harvester Co.
Governor test stand	Woodward Governor Co.
Lapping lathes	Schauer Machine Co.
Injector needle grinder	American Bosch
Pop testers	2 - American Bosch
	2 - Bacharach Industrial Instru. Co.
	1 - Fairbanks-Morse & Co.
Flat lapping machine	Diesel Control Corp.
Plunger and barrel leakage tester	Merlin Engineering Co., Ltd.
Balancer	Trebel Corp.
Cleaning compound	Turco Products, Inc.

on springs and other parts. After cleaning, the parts get a thorough hot water-and-air rinse."

"Now, back to the pump."

"After assembly, it goes to the appropriate calibration stand. We have a stand for multi-cylinder pumps, one for the individual type and the International Harvester test stand. In the same room we have our governor test stand. Also, all our test specifications are kept there.

"Since we do work on all makes, we've had to make adapters. For example we made the adapters for testing RoosaMaster vertical-drive pumps and also the "D" pump when it comes in without a drive shaft. We also made them for the Cummins "SD" units."

"How about parts."

"In our franchized lines, we have no trouble at all. We carry a good stock of all parts. We manage to get the other parts one way or another. However, it would be a big help if more realistic discount structures such as you can get in the automotive industry were available to us. After all, we *are* doing the work and, in general, prefer to use original parts. If we can't get them from the manufacturer at a reasonable price, we get them elsewhere."

"Now, what about work on nozzles?"

"You can see from all the test equipment, the lapping lathes and flat lap, the needle grinder, and all the other tools that we can handle any of them. We're building up our own stock of the more popular nozzle (and injector) assemblies so that we can start an exchange service."

"How about work load?"

"We keep four men and myself busy all the time between the injection equipment and governors. There is no specialization; they are well-trained, all-around men."

"Finally, do you have any particular specialties?"

"Right now, I can't think of any. Tonight, I'll think of a dozen. We stick to recommended procedures, keep everything clean and do the best job that we can. Here's an example of how we extend cleanliness outside of the shop. Notice these plastic closures on all these pump openings? We put them, or the original shipping caps, on all equipment to protect it until it's used.

"Come to think of it we do have one specialty, outside of the injection and governor field, though. We have a balancing machine. We have done a lot of balancing on such things as blower rotors and turbine rotors. It seems that there is a big and growing field for this type of service. We're hoping to get into turbocharger repair."

Once these two companies were one. Asking the reason for the change brought out the reason that each company has its own individual accounts. The interests of each are somewhat different. Yet in the areas where they overlap, they complement each other to present an integrated and complete service to the engine owner.

Towing coupling on 3080-lb P-D unit is adjustable for height for use with any rear-mounted implements.

Air-Cooled Porsche-Diesel Tractors on Way to U.S.

TRACTORS with air cooled Porsche-Diesel engines are now being shipped from the works in Germany. Units of 12, 22, 33 and 44 hp are en route to Bridgeport, Conn., home of Porsche-Diesel Imports. Initial shipping rate will be 100 tractors a month.

Among advantages claimed for these models are faster warm-up, greater power, fuel saving and constant performance with less wear.

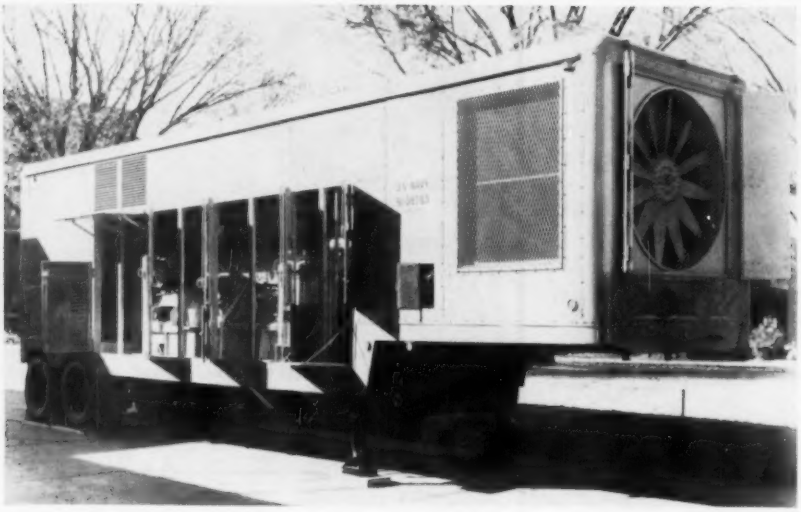
Fluid drive protects the unit from shock of rough terrain and obstacles. On level ground the engine starts in third—with first and second being reserved for tough ground conditions. When an obstruction stops the tractor, the clutch is automatically disengaged so the engine is not overloaded.

Overheating and freeze-up with resultant wear are avoided since the air flow can be regulated at will. The 1-cyl, 12-hp diesel has dual power take-off, with four forward and four reverse gears. Both the 2-cyl, 22-hp unit, shown here, and the 3-cyl, 33-hp engine have three power take-offs with five forward and five reverse gears. Largest of those being exported to the U. S. is the 4-cyl, 44-hp heavy-duty tractor. This has two PTO shafts, one running at standard speed and the other working independently of the clutch.

Rear tires can be braked independently from the smaller front tires. This gives the tractor a turning diameter about twice the vehicle's width. A differential lock allows the machine to recover from soft ground when one wheel slips.

Since width of the wheel base is adjustable, these P-D tractors are quite versatile units for agriculture, forestry, industry and construction applications.

All models are built-up from standard basic units. Principal components fit all types and parts are interchangeable.



F-M's opposed-piston diesel can be seen through the open doors of the engine compartment. The engine cooling compartment is seen at right, the control compartment is at left. The complete mobile unit is supported by jacks and is ready for operation.

Complete Electric Power Plant On Wheels

Electrical power when you need it—where you need it. Wheel it in, hook it up, fire it up and you're in business with substantial chunks of high-quality electrical power. It's a growing trend.

"MORE power with mobility" appears to be the modern trend. Electrical power for utility service-peaking, voltage-pickup, emergency and maintenance work—is one type of service. Then there are the uses for large construction projects, and by general industry for temporary service and standby.

Keeping in step with this trend, Fairbanks, Morse & Co. has just delivered its first 675-kw trailer-mounted diesel generating plant. This unit, one of two ordered by the Navy's Bureau of Yards & Docks, is intended as an emergency power source for established yards and bases and an immediate power supply for any construction site or isolated installation in the world.

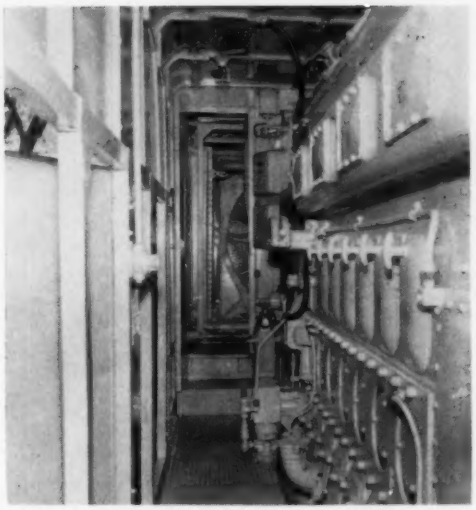
Measuring 36 ft 2 in. in length, 8 ft in width and 12 ft 6 in. in height the plant weighs 72,000 lb, less than 107 lb per kw. This includes a 6-cyl Model 38D8-1/8 OP diesel rated 962 hp at 720 rpm, generator, switch-gear and control equipment, complete cooling, lube and fuel systems, starting air compressor and auxiliary engine. The semi-trailer also includes a 450-gal fuel tank, sufficient to run the diesel at full load for 9 hours.

After a highway tractor hauls the trailer to where it is needed, it can start delivering power immediately after it is hooked to the distribution line. Two or more units could function as an integrated plant, quickly providing any required power supply.

In addition to the 675-kw plant F-M has announced three smaller trailer-mounted units rated 350, 400, and 500 kw. These incorporate the smaller version of the OP diesel with a 5¼-in. bore and 7¼-in. stroke. The three smaller mobile stations are 32 ft 7 in. long, 8 ft wide and 11 ft 10 in. high.

The 500-kw unit with its 750-hp, 10-cyl diesel weighs 51,500 lb. The 400-kw plant with its 600-hp, 8-cyl engine weighs 47,500 lbs. And the 350-kw unit with a 525-hp, 7-cyl diesel weighs 45,100 lbs. These are dry weights, but addition of fuel, lube and cooling water still leaves the plants well below highway load limits. The built-in fuel supply is sufficient to run these engines at full load for 12.2 hours, 14.2 hours or 16.1 hours respectively.

Despite space limitations all four mobile plants incorporate heavy-duty engines and standard accessory equipment. A scavenging air blower, lube oil pump and cooling water pump are mounted on the 2-cycle diesel. A pair of radiators are cooled by a motor-driven fan. The engine-driven pump circulates coolant through the oil cooler, engine jacket and radiator. Both water and lube circuits have thermostatic valves.



Adequate inspection and servicing space is available on each side of the engine. The motor-driven fan seen at the end of the engine compartment draws air through two radiator coils.

A full complement of filters protects the engine. Scavenging air is cleaned by oil-bath filters. The lube circuit has both a full-flow strainer and a cartridge-type by-pass filter. Fuel is filtered before the header that feeds the injectors. Alarms protect the engine against high water temperature and low lube pressure with either automatic or manual shutdown as desired. Engine operation is controlled by a hydraulic governor. Exhaust gases are passed through snubbers.

Starting air is furnished by a motor-driven compressor and is stored in tanks with enough capacity for three starts. A 6-kw diesel-generator set supplies energy for compressor, lighting and other auxiliaries when the main engine is shut down. The small generator set is started by a 24-v battery.

The main engine drives a 2400/4160-v, 3-phase, 60 cycle generator with an exciter mounted on top of the generator. A switchgear enclosure provides space for mounting equipment to meet customer requirements. There is also space for conductor links for wye or delta connection, line disconnect switches, and transformers to step down voltage for the fan motor, lighting and auxiliary equipment.

A protected terminal board on the back of the switchgear enclosure makes it easy to connect to a distribution line. This may be brought through either of two small doors on both sides of the trailer body near the roof line.

The trailer has a sturdy steel underframe to support the equipment. An aluminum body is divided by bulkheads into an engine cooling compartment, an engine compartment, and a control compartment. Slide doors provide for easy access and routine maintenance. The aluminum body can be lifted off as a unit for major overhaul.

Automatic Diesel-Compressor

TODAY'S demand is for increased use of completely automatic, self-sufficient diesel powered units for all applications. Nordberg's latest contribution to this field of automation is an automatic diesel-air compressor.

The so-called "Dies-l-air" is designed for service in remote areas when commercial power is not available. It is monitored by a control unit made by Automatic Power, Inc., for whom these units are being built.

The compressor unit has a capacity of 30 cfm at 60 psi, and 26 cfm at 100 psi. It consists of a 2-cyl Nordberg Power Chief diesel with one cylinder converted to an air compressing cylinder. The diesel cylinder head is replaced by a compressor cylinder head but the piston and rings are unchanged.

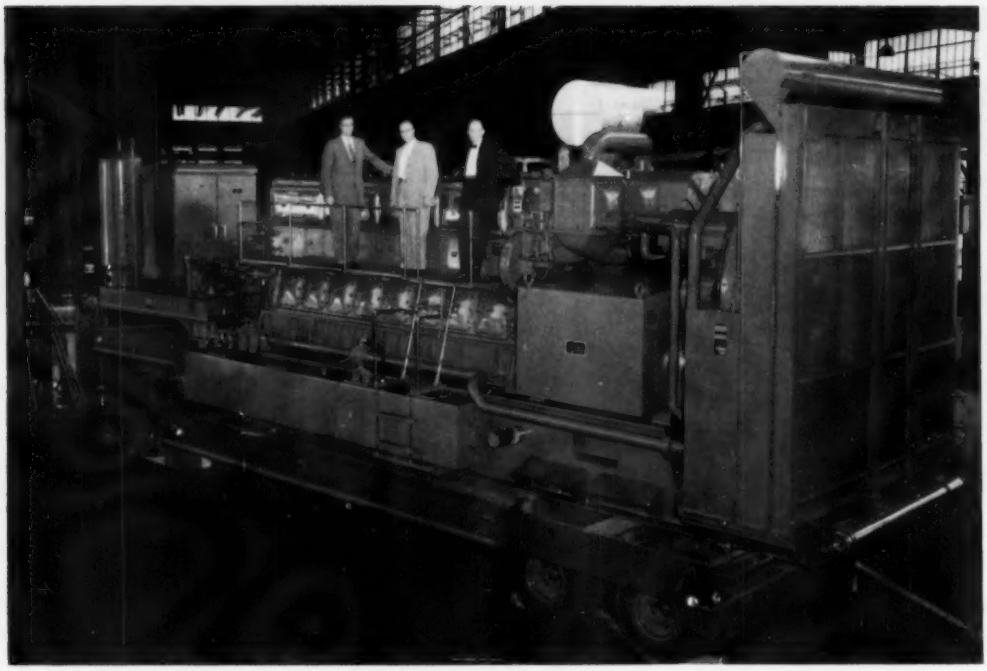
A concentric-type compression valve which combines both suction and discharge in a single unit is incorporated in the head. This permits a minimum clearance in the cylinder and easy accessibility.

A large radiator permits operation at ambients up to 125°F. A thermostat holds jacket water at 130°F.

Principal application of the unit is powering a foghorn for installation on navigational hazards such as off-shore oil well drilling rigs and production platforms. For this service, two units and its dual automatic engine control (DAE-10) are used. They are housed in a portable skid-mounted steel enclosure.

For unattended operation (30 days) one engine runs continuously to maintain sufficient compressed air in a storage tank. An unloading valve on the compressor cylinder controls the pressure in the tank. During this cycle the engine governor maintains a constant 800 rpm, giving maximum fuel economy.

The automatic control unit monitors lube oil pressure, jacket water temperature, compressed air volume and battery charging circuit. If any one of these exceeds an established safe range, the controls stop the engine and start the standby unit. An interconnected cooling water system betweeen the two engines keeps the standby engine warm for instant starting. The controls also monitor an indicator flag which shows if any system has exceeded the established safe range.



Switchboard, gasoline engine-driven air compressor, and vertical air tank are located at left end of unit. Fuel tank with filters, hand pump and inspection plate can be seen at lower center. Radiator with top-mounted surge tank, intake air aftercooler and combination air filter silencer (above alternator enclosure) are seen at right.

White Builds 1250-KW Mobile Unit

Factory-engineered, self-sufficient mobile power plants offer important economic and applicational advantages. As sizes increase, the applicational potential is broadened. Here are details of one of the most powerful of such plants to date.

A COMPLETELY factory engineered, self-sufficient mobile power plant has just been exported by the White Motor Co. This 1250-kw packaged unit is the largest built to date.

Dual benefits are realized by use of units such as this and being fully aware of the trend, White engineers are capitalizing on it. For one thing, the high cost and lengthy periods for constructing buildings, foundations, etc., for permanently installed diesel generating sets are eliminated. In addition, any one or combination of these units can be moved immediately to a disaster area, or used for peaking, or suppling power in remote sites.

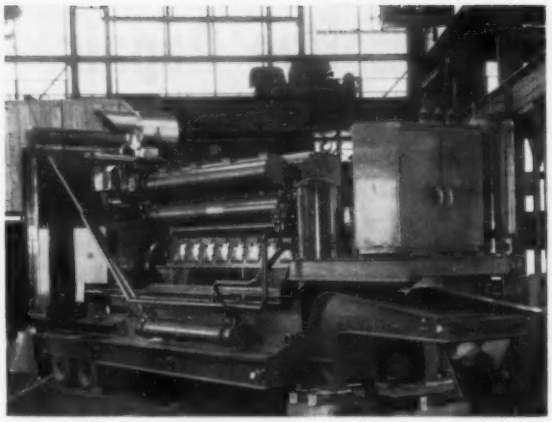
The other benefit is obtained through the fact that the factory engineered unit gives matched components chosen because of compatibility to give the most dependable and efficient operation.

There is a growing awareness of all these benefits as evidenced by the number of manufacturers now producing mobile, self-sufficient units in a wide variety of types and sizes.

For example, White's unit is a 3 phase, 60 cycle, 2400-v, 1250-kw weatherproof package. It was developed by the White Diesel Engine Div. of The White Motor Co. for the Instituto Venezolana Petroquimica, for use at a major construction project in Venezuela. This is the group responsible for development of Venezuela's petrochemical industry under the guidance of the Minister of Mines and Petroleum.

All components, including White's Superior 12¾-in. by 15-in. bore and stroke, Model 65 ASX8, 1765-hp, 8 cyl, in-line, turbocharged diesel were packaged for proper weight distribution. The steel skid structure supporting them takes full advantage of the lines of the 39-ft trailer which carries it. Main components are grouped on a low deck, with controls and auxiliaries riding forward above the "gooseneck" which rises over the tandem axle of the Autocar tractor.

When the power plant rolls onto its location, the Autocar tractor can be detached for other uses, and the 16-wheel trailer is leveled to provide a proper operating base



Vertical air tank is seen at right of switchboard. Lube oil filter is at left of panel. Horizontal lube oil heat exchanger is at lower center. The turbocharger can be seen at top left of unit.

for the power plant. For more permanent use, the package unit could be 'snaked' off the trailer with a bulldozer and placed on a level site. Pickup by the truck would then be accomplished by use of a truck-mounted winch driven off the truck engine.

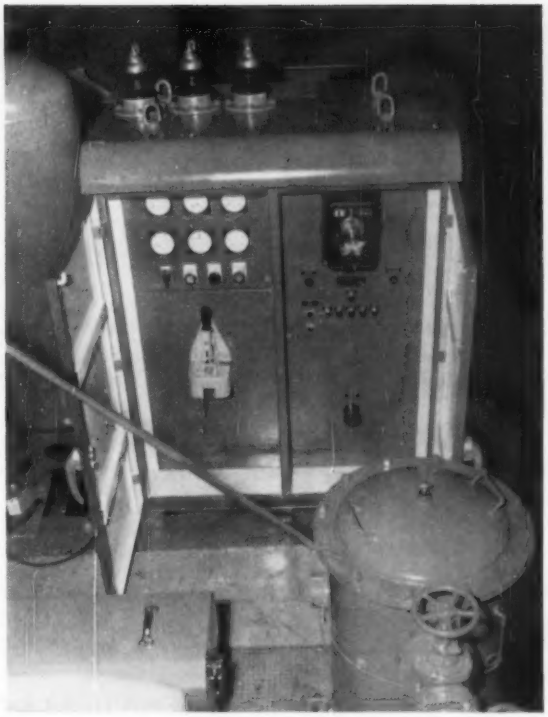
Dimensions of the entire package with trailer are 39 ft long, 10-ft 8½-in. wide, and 17-ft high in operating position. It was necessary to export the unit on the Grace Lines' S. S. Santa Rosa because it is one of the few vessels in the trade with the cargo loading and discharging capacity of sufficient size.

Underway, the truck, trailer, and diesel electric generating plant are an 80 ton combination. Off the trailer, the power plant is a self-sufficient 58-tons of equipment. The fabricated steel engine drives an Ideal 12-ton alternator with belt-driven, top-mounted exciter. It is also equipped with an 11-ft square cooling radiator, fuel tanks, filters, silencers, lube oil heat exchanger, intake air aftercooler, and other necessary equipment for completely independent operation. A gasoline engine-driven air compressor furnishes air for starting the diesel.

These units are combined in a package built to operate without shelter on a series of heavy construction projects that will materialize under Venezuela's public works expansion program. If it would eventually be used in one of Venezuela's growing cities, the unit can handle the power needs of a town of 10,000.

In developing the mobile plant, components were chosen which will stand severe service. White's heavy-duty Superior diesel has been proven an efficient power producer under a wide variety of load conditions. Its 600-rpm speed indicates long engine life while its clean modern design gives maximum protection to moving parts and is easy to service.

Fuel tanks are integral with the unit to insure continuous operation when fuel tank trucks are being refilled. The engine operates on a non-premium fuel—a decided advantage on construction projects restricted to the availability of all grades of fuel.



Weatherproof electric switchboard has all necessary equipment for controlling and transmitting 2400-v, 3-phase, 60-cycle current.

Use of the power unit at varying altitudes will not hamper engine operation. It has a considerable power reserve in line with its conservative continuous rating of 1765 bhp.

The 39-ft power plant is controlled by a switchboard mounted forward of the engine. One operator per shift can easily handle the unit. Power output is taken from insulated terminals on top of the weatherproof electric control panel. Walkways are conveniently mounted for routine inspection.

Principal Equipment

Diesel engine	White Motor Co.
Alternator	Ideal Electric & Mfg. Co.
Exciter	Ideal Electric & Mfg. Co.
Distribution panel	Ideal Electric & Mfg. Co.
Fuel tank	White Motor Co.
Turbocharger	Elliott Company
Air Silencer and cleaner	The Air Maze Corp.
Aftercooler	Young Radiator Co.
Radiator	Young Radiator Co.
Temperature regulator	Amot Controls Corp.
Fuel filter	Purolator Products, Inc.
Lube oil filter	The Hilliard Corp.
Lube oil heat exchanger	Ross Heater & Mfg. Co.
Governor	Woodward Governor Co.
Exhaust silencer	Maxim Silencer Co.
Air compressor	Quincy Compressor Co.
Alarm panel	White Motor Co.
Fuel transfer pump	Geo. D. Roper Corp.
Trailer	Fruehauf Trailer Co.
Tractor	Autocar Div., White Motor

Special Devices Speed Locomotive Repair

Cost-conscious railroads cut downtime by developing special repair methods and tooling.

TO expedite diesel locomotive maintenance and repair, many new tools and devices are used in railroad shops. This cuts costs. Many are even built by the personnel themselves.

Data on just a few of these shop-built devices has been made known mostly through railroad club and association committee reports and magazine coverage. One reason why more have not been given publicity is the reluctance to call attention to original designs. It is generally felt that the designs may be improved upon.

Let's discuss some of the devices made and commonly used in some of the railroad shops.

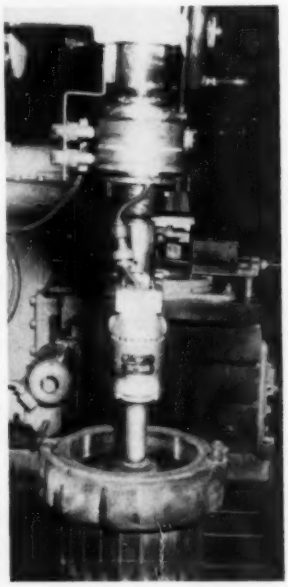
A cylinder liner ridge grinder removes the shoulder left by wear above the limit of top ring travel. Designed for chromium-plated liners, it is equally useful for work on EMD liners.

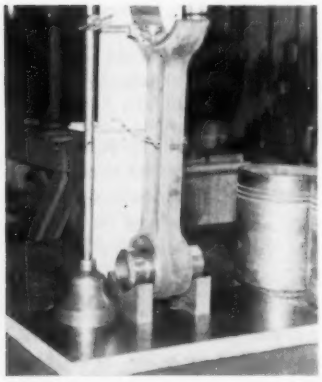
A portable electric grinder is carried on a bracket and a shaft mounted on the spindle of a vertical drill press. The bracket arm is pivoted with a spring to maintain suitable grinding wheel pressure against liner bore. Length of bracket arm is determined by the inside diameter of the liner.

The rotating and travel speeds of the grinder into the bore are controlled by the operator. The table arm is provided with a centering plate to insure accurate positioning of the liner.

A shop-built current collector (shown just below drill press hand wheel) permits full 360° rotation of the grinder. The brushholder is supported by a bracket from the non-rotating rack on the spindle bushing.

This device is said to remove a liner ridge about 75% faster than methods previously used.





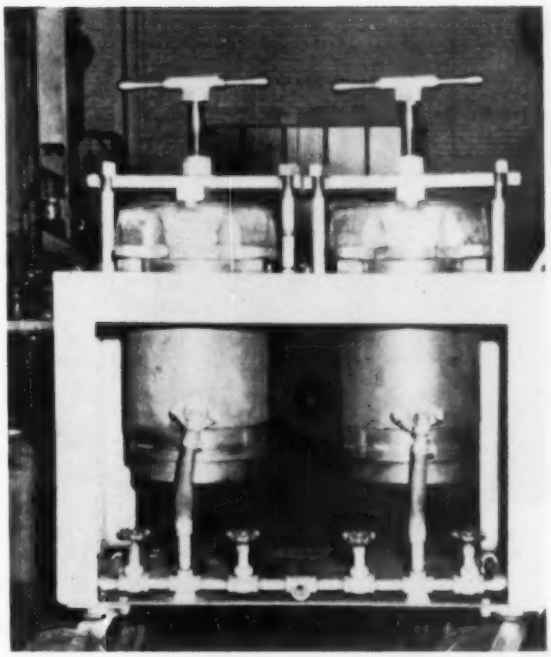
To check connecting rod alignment, the jig shown is used. A piston pin is fitted into the connecting rod eye so that it extends out evenly at both ends. The two ends of the piston pin are then placed in identical vee-blocks resting on a surface plate with the connecting rod held in a vertical position.

A dial indicator locked rigidly to a vertical bar is then set in contact with one side of the connecting rod bearing bore surface and a reading taken. The same procedure is followed on the other side of the bearing bore and the two readings compared. Any deflection of the dial indicator needle means misalignment.

Testing cylinder liners before assembly for defects leading to water leaks is important. Defects are difficult to detect by visual inspection and almost impossible to determine the cause of leaks with the engine running.

Two different methods of Alco liner inspection are shown. One railroad uses a hydrostatic testing device designed to handle two liners at the same time. Liners and water jackets must be assembled first, then after inserting through the top of tester, the assemblies are supported by the top plate of the device. Two pressure heads are then placed on top of liners and a bar over each head is rotated into position with the slots in the ends of each bar engaging two hold-down bolts. A screw clamp through the center of each bar is tightened sealing the pressure heads to the liners.

Next, a fitting is bolted to each liner jacket assembly at the water supply opening. These are then coupled by flexible rubber hose to a water pipe across the base of the tester. By opening and closing valves in the pipe connections, each liner may be tested independently. A shop water line pressure of 50-60 psi meets the manufacturer's recommendations and is satisfactory in locating leaks.

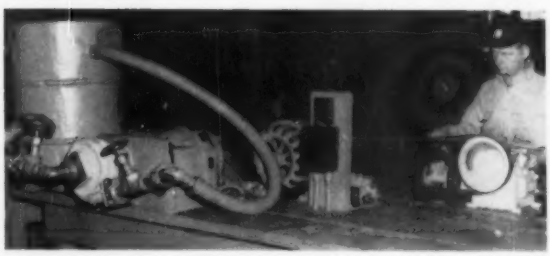


Zyglo inspection is also used for leaks. This is said to give more positive results than hydrostatic testing. Four gallons of Zyglo ZL-2 penetrant is poured into a steel drum (14-in. in diameter by 18-in. high) located in one tank of the inspection unit. After cleaning a liner in an alkali solution, it is sealed by a plate at the bottom and lowered into the drum. The penetrant surrounds the liner with the level just below the top of the liner.

The liner remains in the drum for about 10 minutes to allow the penetrant to seep through any hole, crack or porous area. The inside bore is then visually inspected with a black light to fluoresce any penetrant which may have seeped through the cylinder walls indicating a porous or leaky condition.

If the inspection does not disclose any defect, the liner is cleaned in alkaline solution, then thoroughly flushed in running water.

Pump test stands for testing diesel engine cooling water pumps and steam generator water pumps, each individually motor-driven, are typical of those found in one railroad shop. Electric motors are permanently attached to frames designed to hold various types of rotating equipment such as pumps, blowers, etc., found on diesel locomotives.



A portable train line test machine, consisting of a combination of lamps, switches and relays is arranged for control-circuit tests of diesel locomotive units.

When connected by cable jumpers to the rear end of an "A" unit set up for a dry run, it indicates continuity and sequence of all cable jumpers. When coupled to a "B" or "C" unit, it takes the place of an "A" unit. It is designed to be used as a master control for a "B" or "C" unit in setting engine speeds, checking transition with main generator voltage, and load testing the engine.

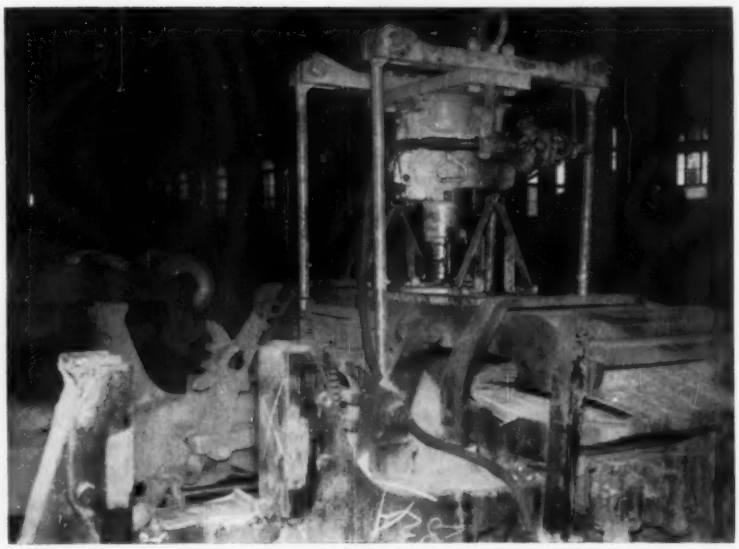
Through use of various switches, all train line conductors may be energized to provide a sequence test of the operation of signal circuits, cam switches, governor circuits, relays, sanding and compressor governor circuits, and steam generator and electro-pneumatic brake circuits. When coupled to a "B" or "C" unit, an indicator box containing a group of lamps can be used on the opposite end to indicate sequence of the train line circuits through the unit.

With a cable and plug connection to the governor, speed sequence tests can be made or the current to individual governor solenoids can be checked with a millimeter. Also, a connection makes possible the checking of the governor plug and governor wiring on the locomotive unit for continuity and sequence.

A hand-operated hydraulic press was shop-built and used to remove and insert bushings into the connecting rod eye. The hand-pump seen at lower left (on floor) is used to pump up pressure in the cylinder attached to the U-shaped steel frame on the work bench.

Jig for compressing springs in locomotive trucks was made and is being used by at least one railroad repair shop. This jig permits easy removal of suspension hangers during the dismantling operation of a truck such as the inverted one seen in the photograph.

The jig is made up mainly of an old jack operated by an air motor. The entire unit is supported on the necessary frame and holding rods as shown. The holding rods keep the truck frame from moving as the jack compresses the leaf-type springs at each end of the truck.



Load-Sensing Governor Anticipates Speed Changes

Closer speed regulation is possible if the governor reacts to load changes before they can affect engine speed.

A NEW load-sensing governor for engine-driven generator sets has been announced by the Woodward Governor Co. It moves the diesel throttle to adjust for the new load within one hundredth of a second after sensing a load change in the generator output. This adjustment, just a close approximation, is followed by a precise adjustment by the speed-sensing element of the governor.

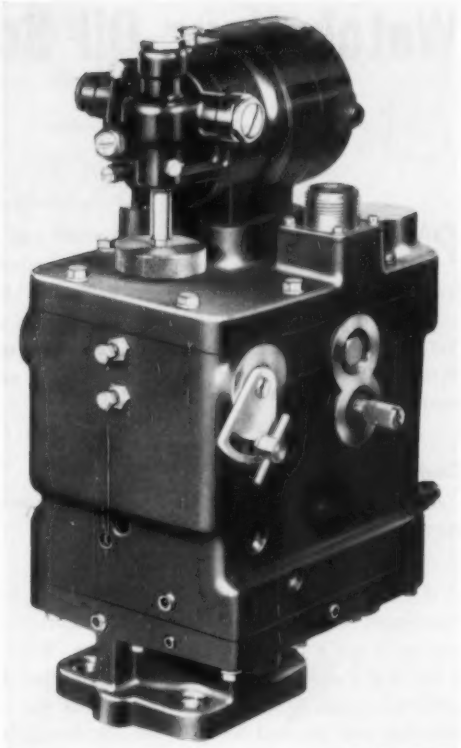
The new governor provides positive control of the engine at all times—even if the electrical load-sensing circuit fails. The Woodward speed-control element is isochronous. It provides for constant engine speed regardless of load within the engine capacity. Thus the governor controls the engine with zero speed regulation.

This governor consists of four elements compactly housed within itself and in a small auxiliary control cabinet. These include a load-sensing element hooked to the generator output, a rectifier, a speed-control governor and a servomotor operated trimmer to correct for varying power factor of the generator load.

The load-sensing element is electrically operated. It senses a load change and energizes a solenoid before the change affects engine speed. This activates the load control which in turn adjusts throttle position to the approximate new load requirement. The speed-control governor then corrects any slight error in fuel requirements.

Changes in the position of the speed-control element activates a hydraulic servo system that automatically adjusts the electrical trimmer to compensate for the new power factor. These actions are all completed within three or four tenths of a second from the load change.

The new unit is capable of controlling single or multiple synchronized power systems with zero speed regulation and is applicable to engines driving generators up to 300-kw capacity.



Woodward's load-sensing governor moves throttle within 1/100 of a second after sensing generator load change.

Components of the Woodward load-sensing governor are seen here.

Watch Your Oil Seals

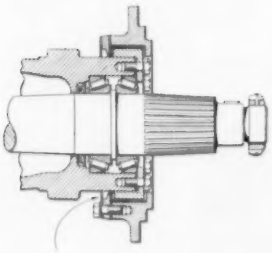
Uses of and methods for installing oil seals.

PARTS doing a big job are often small and seemingly insignificant. Take, for example, the seal at the forward end of a crankshaft. When compared to the size and cost of a crankshaft, its size and cost is negligible. Yet, if this small seal is not installed correctly or replaced shortly after it leaks, serious damage to the engine may result.

Common Oil Seals

Let's discuss some uses and methods of installing the more common seals.

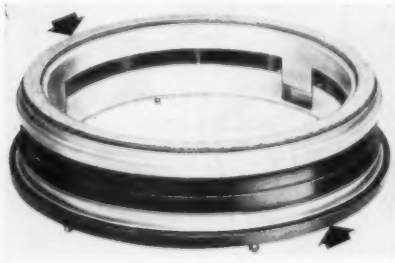
A felt seal is ordinarily used where its principal requirement is preventing entry of dust. Retention of oil or grease is not a requirement in this case. When installing a felt seal it should be impregnated with lubricating oil to protect it from overheating and wear. If the installation requires that the seal be split, the cut should be made at an angle.



Arrow points to felt seal. This type of seal is generally used to prevent dust or dirt from getting in.

Cork seals are sometimes used instead of felt seals. While cork seals give good protection at temperatures up to 150°F, they are not recommended in applications where they will be exposed to acids, alkalies or high pressure.

When used against a solid backing such as on face-type seals, cork effectively retains grease in a compartment and excludes water and dirt. When installing a face-type seal with a cork face, the cork face should be coated with graphite grease.

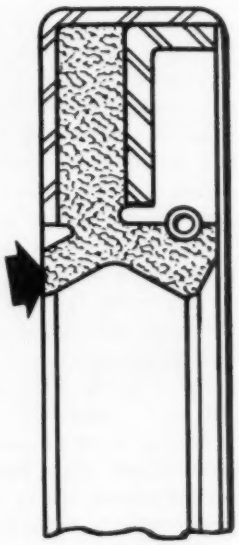


Top arrow shows example of cork seal. Bottom arrow shows a Neoprene seal.

Leather and rubber are widely used sealing materials. Their most common use is in *lip-type seals*. However, leather is being replaced by synthetic rubber in many of its applications. In most applications the rubber lip seal provides better sealing at high speeds, high temperature and where misalignment and run-out conditions exist. Rubber lip-type seals are also effective dirt seals.

In some cases, leather seals are definitely specified. Therefore, unless a rubber seal is recommended the original leather lip seal should be used.

Lip seal is indicated by arrow. Generally, single lip seals should be installed with the lip pointing toward the material to be sealed.



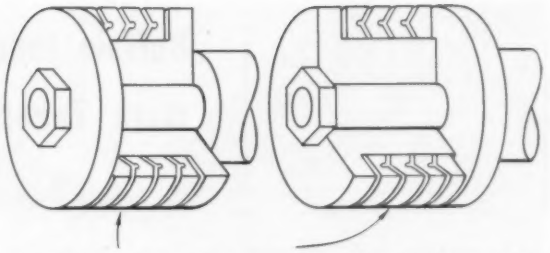
When possible soak a leather lip seal in warm oil for about a half hour prior to installing. A rubber lip seal should just be dipped in oil. Install the seal with the wiping edge turned in the direction recommended. Generally, single lip seals, (leather or rubber) should have the lip pointing toward the material to be sealed. That is, if the main function of the seal is to exclude dirt from a compartment, the lip of the seal should be pointed toward the outside. If the main function is to seal lubricant in a compartment, the lip of the seal should point toward the compartment containing lubricant.

A double-lip seal, whether leather or rubber, frequently has one lip wider than the other. In applications requiring such a double-lip seal, the spring of the seal, (which has the wider lip) should always point toward the lubricant to be sealed. Sometimes two compartments containing lubricant are separated by a double-lip seal. In this case, the wider lip should point toward the compartment containing the higher pressure or the most lubricant.

Installation Methods

There are several ways to install lip-type seals. Special tools are available for driving the seal in place and also for preventing damage when it must pass over sharp shoulders, etc. However, if the seal must pass over a sharp shoulder, keyway or spline, but no special tools are on hand, shim stock may be wrapped over these areas. The shim stock should then be lubricated to provide a smooth sliding surface for the seal lip.

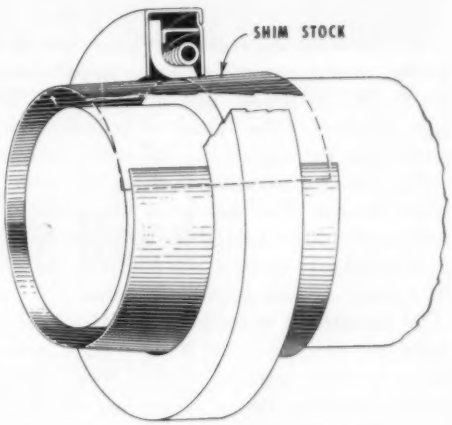
If shim stock is not available, a heavy paper coated with grease will work satisfactorily. To drive the seal in place use a driving member that will press against the outside rim of the seal if a special tool is not available.



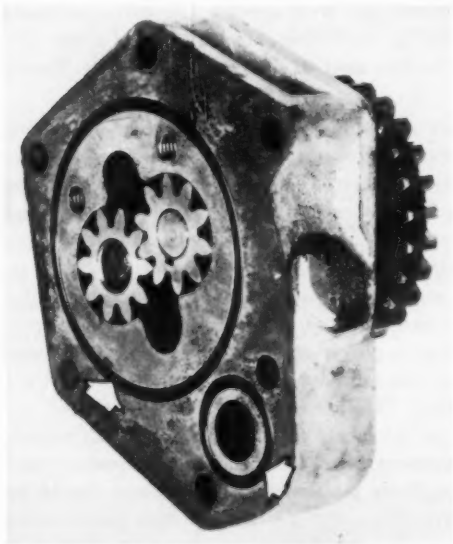
Arrows point to chevron seals used in hydraulic pistons. Point of chevron should be in direction of major hydraulic pressure.

Another commonly used synthetic rubber seal is the *O-ring seal.* This seal should be dipped in oil just before installing and should be rolled over the shaft on which it is to be installed, or placed into its groove with a minimum of stretching. Also, the O-ring should not be twisted when placed in its groove.

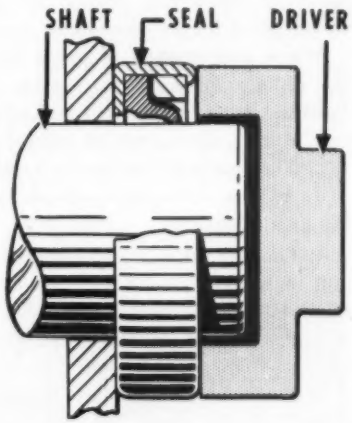
When once used, O-ring seals conform to the shape of the groove in which they are installed. However, since they are inexpensive, they are always replaced at disassembly and only reused in an emergency.



Shim stock is shown protecting the lip of the chevron seal against sharp edges during assembly.



Arrows point to O-ring seals. Be careful not to twist or overstretch these seals when installing.

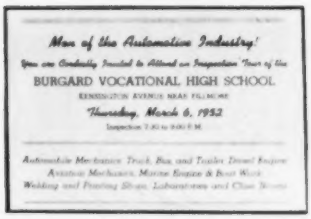


Chevron seal is seen being installed. The seal should be put on by driving against the outside rim with a special tool.

Chevron-type packing seals are generally used in hydraulic pistons. Direction of assembly is most important to effect a seal with this type of packing. It should be installed with the point of the chevron in the direction in which the major hydraulic pressure is to be applied. The lips of the packing will not catch on sharp edges when installed this way. Sufficient shims should always be used behind the packing gland to give the chevron packing a slight press.

Conclusion

As previously mentioned, seals are generally small in size and cost very little—however, they play an important part in the life of any equipment where they're used. Leaking seals should always be replaced. Those found to be in questionable condition at reconditioning should also be replaced. Future downtime and possible costly repairs will thus be prevented.


Men of the Automotive Industry!
You are cordially invited to attend an Inspection Tour of the
BURGARD VOCATIONAL HIGH SCHOOL
KENSINGTON AVENUE NEAR FILLMORE
Thursday, March 6, 1952
Inspection 7:30 to 9:00 P.M.
Automobile Mechanics, Truck, Bus, and Trailer Diesel Engine
Aviation Mechanics, Marine Engine & Boat Work
Welding and Painting Shops, Laboratories and Class Rooms

Buffalo Industry and Educators Work Together to Ease Mechanic Shortage

By Robert Dyment

MORE diesels go into service every day. The total number in service is greater than ever before. Now there is a growing awareness of a shortage of skilled mechanics to take care of these engines. Reports of acute shortages are heard from different parts of the country.

What's being done about it? For one thing there is greater emphasis seen in engine builders' training programs. Mobile schools are increasing. IH has it's own type program. Other plans of industry are aiding in publicizing the opportunity for skilled technicians.

Snap-On, for example, is doing this with a series of advertisements. One shows that this problem is not confined to the diesel field. They point out that in the automotive industry there is one mechanic for 82 cars. And they don't say how good he is, either.

So something must be done. Here's one idea that's being put to work in the Buffalo, N. Y. area. Its trucking industry is working hand in hand with the Buffalo public education system. For years the Burgard Vocational High School has furnished apprentices for the automotive service industry.

But in recent years, the demand for diesel repairmen for motor carriers, truck manufacturers' factory branches, truck equipment groups and general truck repair shops called for an accelerated training program.

Ways and means of doing this were discussed by the Buffalo Trucking Association and Burgard V.H.S. Pertinent facts brought out and actions taken were:

1. A critical shortage of trained mechanics did exist.
2. The shortage was due to rapid industry growth.
3. At least 155 competent mechanics were needed in the area at once.
4. Local industry could use 40-50 apprentices yearly.
5. A training course for truck and bus mechanics was to be set up at Burgard at once after contacting the superintendent of schools, the board of education, and even the City Council if necessary.
6. Companies would make donations of diesel engines, parts and other items.
7. One large automobile shop in the rear of the school would be rearranged for truck and bus work.
8. Representatives of the truck and bus industry would cooperate in matters of program planning; recommending men qualified for training as competent instructors; aiding in securing facilities and equipment; and offering advice to maintain a high grade program.
9. A committee of ten from the industry were selected to work with the school. The committee consisted of a chairman and members as follows: 2 truck and bus factory branch service managers; 1 truck and 1 bus fleet service manager; 1 factory branch manager; 1 independent truck and bus repair shop operator; and representative from each trucking and garage association.
10. An immediate survey was made of what each representative wanted in the training program.

It was found that 32,503 trucks and 2500 buses, as well as 10,000 trailers are serviced in Erie County, where Buffalo is located. A minimum of 250 mechanics were needed annually, as well as probably double this amount for commercial vehicle drivers. Many fleet and bus owners feel that a driver with mechanical and diesel background is an asset.

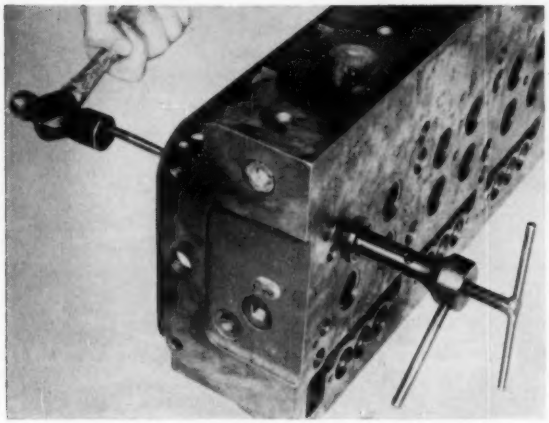
The industry did much to secure the materials and equipment needed at no cost to the school. One company makes available a large quantity of film slides and records as required. Truck units are offered to the school as needed. GM and the Westinghouse Co. furnished units and materials for the course. Mack furnished a new diesel, similar to that used in the Niagara Frontier Transit Co. buses.

Instructors and students are permitted to visit truck manufacturers' and operators' shops periodically to get a better idea of latest techniques and general working conditions. Instructors can go to different shops any time teaching materials, information or units are needed.

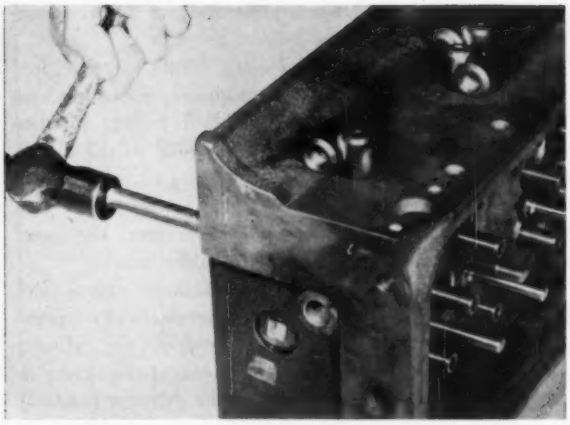
The training course set-up is such that students take apart, assemble, adjust and repair equipment similar to that on which they'll work after graduation. However, more emphasis is put on recognizing when a job is done correctly and not to allow anything to pass which is not 100% correct. This means that when a student approaches a job he should first find out all he can regarding the equipment, then clean the unit thoroughly and disassemble. When reassembling, each piece should be checked individually and positive measures taken to see that it is working properly.

Since the program, started in Sept. 1952, there has been an average of 40 members in each class. All graduates who wish to work in truck repair shops are hired by Buffalo truck operators. However, the number requested by the industry still exceeds the number of graduates. Therefore the program is still a high priority one with the Buffalo trucking and bus industry.

The result is a step forward in helping to assure competent, efficient and well trained mechanics to service the thousands of trucks and buses operating in this second largest city in New York State—and one worth imitating in other areas where a similar shortage exist.



Valve seat insert remover body has been expanded in the insert and driving rod is being hammered against the base of the tool.



Pilot end of valve guide remover has been placed inside valve guide automatically centering tool. Guide is then driven out.

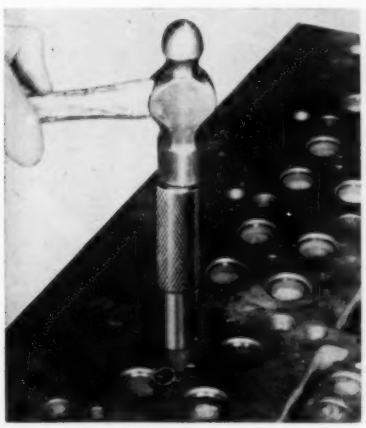
Servicing GM's Four-Valve Heads

Modified techniques and new tooling are needed for GM Series 71 engines with the new 4-valve cylinder heads.

DEVELOPMENT of Detroit Diesel's 4-valve cylinder heads posed new servicing problems. Procedures were immediately worked out for removing and installing all cylinder head parts and making the necessary adjustments. To facilitate removal and installation of these parts, the Kent-Moore Organization, Inc., has come up with special tooling.

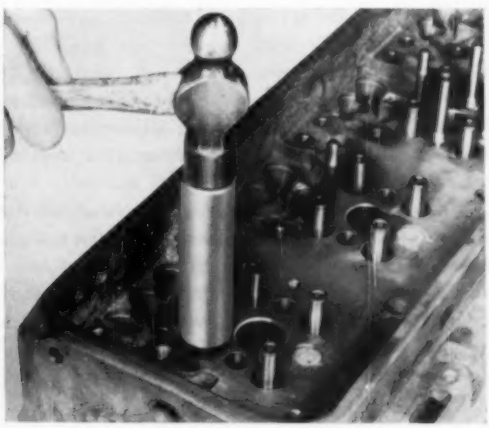
New Servicing Tools

A valve seat insert remover (J 6567) is now available. It is an easy job to remove the insert with this tool. Its special expanding-body design automatically locates the correct depth for gripping the hardened steel insert. To use this tool, merely expand the body by turning the "T" handle while holding the side bar stationary. Then,



Since this tool is press fitted into valve seat insert with long thin end extending inside valve guide, insert is driven true into the head counterbore.

Hole in end of valve guide installer fits snugly over end of guide and automatically positions it as guide is driven in.



place the driving rod against the base of the tool and remove the insert from the hole.

A valve seat insert installer (J 6568) is also furnished. The possibility of a damaged cylinder head or insert caused by the use of makeshift tooling justifies the use of this precision tool. A shoulder on the tool is placed squarely over the insert while part of the tool fits snugly in the insert. The long pilot end of the tool is placed through the valve guide and centers the insert as it is hit into place in the head counter-bore.

A valve guide remover (J 6569) is built with a pilot end which fits down in the guide automatically centering the tool when driving the guide from the cylinder block. In operation, insert the pilot end of the driver in the valve guide and press it out of the cylinder head.

A valve guide installer (J 6570) automatically positions the guide into the cylinder head. This tool, which fits over the end of the guide, insures factory installation tolerances for an otherwise tricky job without damage to the engine.

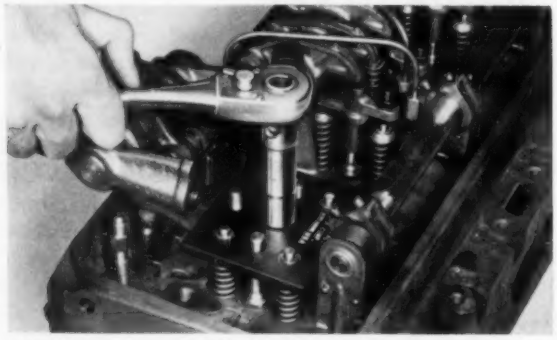


Plate with sufficient holes to allow cylinder head studs and valve stems to protrude through it is pulled down over all four springs at the same time. Hands are then free to install keepers, etc.

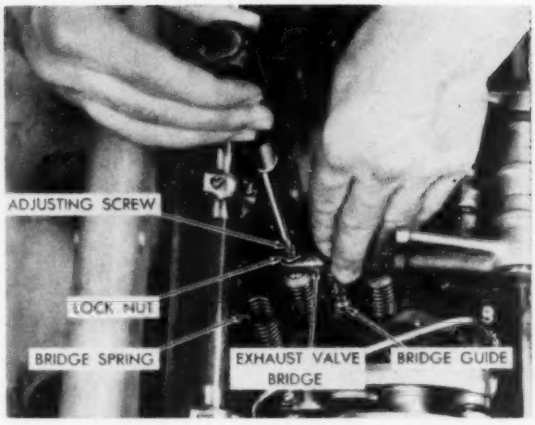
A valve spring compressor (J 6599) compresses all four valve springs at the same time. Essentially, this tool consists of a single plate which extends over all four springs while the valve stems protrude through holes in the plate. This permits you to have both hands free to do a fast and efficient job of removing or installing keepers, valve springs and caps.

Bridge Balancing

Revised procedures have also been developed to establish the proper bridge balancing adjustment and exhaust valve lash setting in all Series 71 engines with a 4-valve cylinder head.

The exhaust valve bridge assembly is adjusted and the adjustment screw locked securely when the cylinder head is installed on an engine. Until wear occurs, no further adjustment is required on the exhaust valve bridge. When wear is evident, a complete bridge balancing adjustment must be made. The following procedure explains how to make this adjustment.

1. Remove injector fuel pipes and rocker arms.



While pressing straight down on pallet surface of bridge, adjusting screw is turned clockwise until it just touches valve stem. Then screw is turned additional ⅛ to ¼ turn and lock nut tightened.

2. Remove the exhaust valve bridge and bridge spring and place bridge in a vise.

3. Loosen lock nut on bridge adjusting screw.

4. Install bridge on bridge guide without the bridge spring.

5. While firmly pressing straight down on the pallet surface of the bridge, turn adjusting screw clockwise until it just touches the valve stem; then, turn screw an additional ⅛ to ¼ turn clockwise and tighten lock nut finger tight.

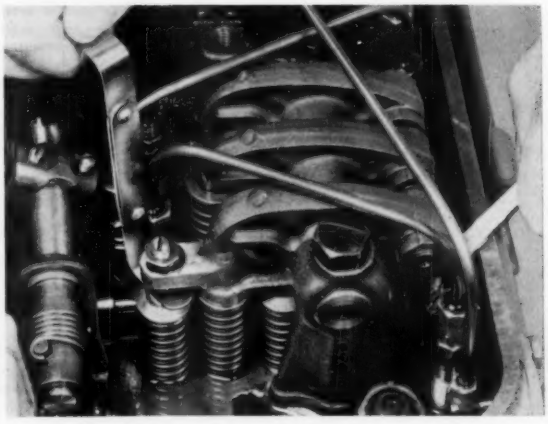
6. Remove the bridge and place in a vise.

7. Using a screwdriver, hold screw from turning and tighten lock nut on the adjusting screw then tighten the lock nut with a torque wrench to 25 lb-ft, being sure that adjusting screw does not turn.

8. Lubricate the bridge guide and bridge pilot with engine oil and reinstall the bridge in its original position without a spring.

9. Place a 0.015-in. feeler under each end of the bridge. Both feelers must be tight while pressing down on the pallet surface of the bridge. If both feelers are not tight readjust the screw as outlined above.

Specially shaped valve lash feeler gauge fits between end of valve stem and adjustment screw easily. It's difficult to use a standard feeler guage because of the arrangement of various engine parts.



10. Remove the bridge and reinstall in its original position with the bridge spring in place.

11. Adjust remaining bridges in a similar manner.

12. If cylinder head has been removed, reinstall the cylinder head on the engine.

13. Tighten the cylinder head nuts to their specified torque before assembling the rocker shaft brackets to the head. This precaution is necessary to prevent valve damage due to mislocated bridges.

14. Install rocker arm assemblies being sure bridges are properly positioned on the rear valve stems.

15. Tighten rocker bracket bolts to their specified torque and connect fuel pipes to injectors and fuel connectors.

Exhaust Valve Lash Adjustment

Insufficient valve clearance results in loss of compression, misfiring and burning of valves and valve seats. Excessive clearance results in noisy operation especially in the low speed range. Therefore, it is essential to set valve lash correctly.

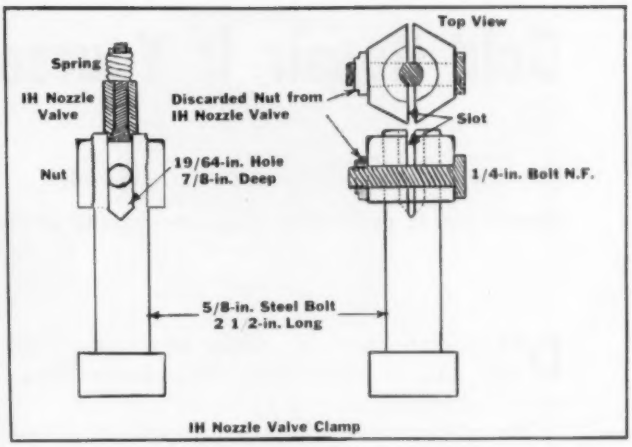
All valves may be lashed in firing order sequence during one full revolution of the crankshaft. But be careful, left-hand turning engines should not be barred in direction of rotation by using a wrench on the crankshaft bolt.

Valve lash must always be adjusted at the push rod. The clearance between the bridge adjusting screw and the valve stem should be set at 0.016-in. with the engine cold. This setting should result in an adjustment of 0.014-in. clearance at normal engine operating temperature. This must be obtained without disturbing the bridge adjusting screw.

After placing the governor throttle control lever in the no fuel position, turn the crankshaft in the direction of engine rotation until the injector follower for number one cylinder is fully depressed. Loosen the push rod lock nut and place a 0.017-in. feeler gauge between the end of the valve stem and the adjustment screw on the exhaust valve bridge and adjust the push rod to obtain a smooth "pull" on the feeler gauge. Then remove the feeler gauge and while holding the push rod with a 5/16-in. wrench tighten the lock nut with a ½-in. wrench.

When valve clearance is correctly adjusted, the 0.015-in. feeler gauge should pass freely between the valve stem and the bridge adjusting screw, but the 0.017-in. gauge should not pass through. Service tool J 6864 should be used to obtain the above adjustment. Check and adjust the remaining valves.

With the engine at operating temperature (160°F-180°F) recheck clearances with tool J 6653. This valve lash feeler gauge is designed and shaped to enable an accurate check of the valve lash. Due to the arrangement of the various engine parts it is difficult to use the standard feeler gauge. At this time, a 0.013-in. feeler gauge should pass between the end of the valve stem and the adjusting screw on the bridge assembly and a 0.015-in. feeler gauge should not pass through. Readjust push rod if necessary and check the remaining valves accordingly.



IH Nozzle Valve Clamp

Shop-Made Clamp Holds IH Nozzle Valve

By Walter Schmidt

EVER have trouble removing the injector valves from IH nozzles? Apparently a special tool is necessary. Unlocking the two jam nuts or backing them off over upset threads frequently calls for something to keep the valve stem from turning inside the valve body.

Use of pliers or even a bench vise to hold the small portion of the valve projecting from the valve body is not very successful. The valve head still slips because the extreme hardness of the metal makes it difficult to get a bite on it.

If a special tool cannot be obtained, here is a method for making up a valve clamp or vise which will work. It will hold the valve head securely and without damaging the metal.

1. Take a steel bolt ⅝-in. in diameter about 2½-in. long with a nut on it.

2. Drill a 19/64-in. hole about ⅞-in. deep into the end of the bolt.

3. Drill a ¼-in. hole across the bolt and nut about ⅝-in. from the end.

4. Saw a slot through both the nut and bolt, 90 deg from the ¼-in. cross-drilled hole to the depth of the 19/64-in. hole.

5. Place a ¼-in. diameter bolt with N.F. threads through the cross-drilled hole. Use a discarded valve stem nut on the end of the ¼-in. bolt to tighten clamp. (This standardizes the use of ⅜-in. size wrenches in this operation.)

The valve head can be held best in the fixture by tapping it in lightly with the clamp jaws under a slight tension.

If necessary, similar clamping devices of appropriate sizes can be made for holding small items in the absence of special tools.

Cold Repair It Yourself

Kit with all the necessary tools and materials

permits you to cold-repair broken or cracked engine parts right on the job.

DO-it-yourself. That's the modern trend. Today, this even includes cold-repairing of cracked or broken essential engine parts.

After you've weighed the pros and cons and decided that cold-repairing is the quickest, least expensive way of getting a lasting repair—another question arises. Can you do a good job of it yourself? If you can—it will cost that much less and get your part in service so much sooner.

But whether you can do it yourself depends on the complexity of the damage and the engine part involved. For repairs such as on freeze-cracks, valve port to cylinder cracks and casting blowouts, all of which will be discussed, the U. S. Casting Repair Corp., markets a do-it-yourself kit. Their "Seal-Lock" repairs, previously known as "Chain-Lock" and available only through licensed shops, can now be performed by anyone equipped with this kit.

This process, proven in over 20 years of actual use, restores cracked or broken castings to good as new condition. Repairs are water and pressure tight, resistant to extremes in temperature, and strains of expansion and contraction. They're also guaranteed to meet insurance approval.

"Seal-Lock" repairs are made without expensive heating, welding or brazing. The process binds and locks the two sides of the crack or break together, then permanently seals it. The kit shown contains all tools, materials and instructions necessary.

How "Seal-Lock" Process Works

"Seal-Lock" repairs involve two steps—first, bridging the crack with locks to prevent further separation of the casting and to restore a safe working strength. Patterns of holes are drilled transverse to the crack to a depth appropriate to the casting thickness. The holes are then filled with lock units inserted one at a time and set with a punch or air hammer to make a strong, tight inlay of locks bridging the crack or fracture.

Seal-locks are scientifically-designed fasteners made of special alloys. They're concave-convex in shape and cambered, enabling them to flatten out and imbed themselves firmly in the base metal after they have been set. The type, number, and size used for a job vary according to the conditions encountered in the damaged part and the working strength needed in the finished repair.

Second step in the process is the use of Sealace to seal the crack between lock inlays, against fluids, air, or gas pressure. Holes are drilled along the crack and filled with Sealace. These are cold-worked to insure a tight joint that completely fills the crack with new metal. When used in combination with locks, they assure pressure-tightness and rigidity in the repaired casting.

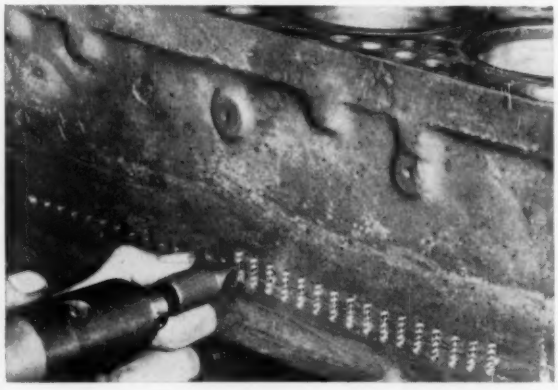
Repairing Freeze Cracks

When repairing freeze-cracks in your block, for example, examine the casting as a whole and the fractured area in particular. Consider the probable cause of the crack and the type of working load the repaired casting will be called upon to withstand (sheer strain, expansive or compressive load). You can't successfully repair a casting which has been seriously weakened by metal fatigue or by corrosion without replacing old metal with new.

Trace the crack to its ends, marking with a light punch. Don't overlook branch or secondary cracks. The repair should cover the entire crack and beyond each end. Determine the thickness of the casting along the crack by drilling completely through the ends of the crack. In a lengthy crack check thickness several times as castings vary within relatively short distances.

Select the proper size lock for the job. (Larger truck and tractor engine blocks use ¼-in. locks.) The distance between lock groups has been engineered and designed to restore up to 90% of the normal working strength of the casting. Placing lock groups too close together re-

Lock patterns across crack are drilled about 75% of way through.



Tools, materials and instructions for making Seal-Lock repairs are contained in this kit. Electric drill, bits, taps and tap holders, chisels, saw, grinding wheels, etc., are seen clearly at right.

moves too much parent metal and weakens the casting. Placing them too far apart does not restore sufficient strength. Castings have a high safety factor of 5 or 6 to 1 and some variations in the spread of the lock groups may be made without danger. But, stay as close to specifications as possible at all times.

In a longitudinal surface crack, spacer jigs from the kit are used at the correct lock spread to establish pattern points. Start slightly beyond one end of the crack and proceed beyond the other. These are the pattern points along the crack where the patterns for the transverse lock groups are drilled. Before spacing the lock design, place the special drilling attachment (lock spacer) over a standard steel drill shank. The lock spacer, specially designed for these repairs, permits free hand-drilling of the spacing required for the pattern.

You are now ready to drill the lock patterns. The repair material must be set into the casting as deeply as possible—but don't penetrate the casting by driving the lock pattern right through. Generally, slightly less than ¼ of the casting thickness should be left as a backing strip under the pattern.

When patterns have been drilled, the locks are laid in starting from the ends and working toward the center of the crack. Each lock must be peened out as it is placed. Use a hand-punch on the first two locks in the pattern as an added precaution against going through the pattern.

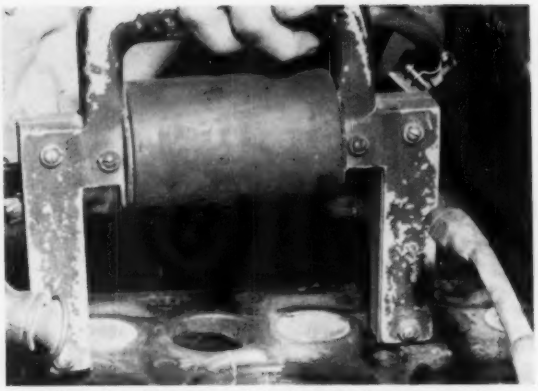
Locks must be kept level in the pattern. Irregularities tend to shear the locks and reduce their strength. If pattern is uneven, use a small quantity of casting dust or a partial lock as a shim to level up. The final lock should protrude slightly above the casting surface after peening.

Next, the crack must be sealed by drilling completely through the casting and tapping each hole with the Sealace tap. The lace should bite slightly into the center lobe of the lock. Each lace bites into the adjoining lace making a tight repair. The laces are screwed in tight and clipped off about ⅛-in. above the casting face.

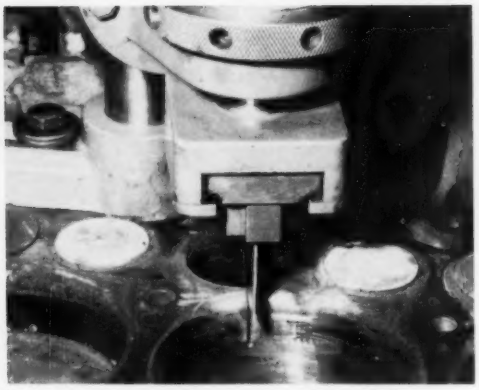
Peen well with a Seal-Lock air hammer to develop the full strength of the repaired metal. But if a repair seaps after completion, additional peening will often correct the leak. Sealing compound is not necessary to stop leaks. A proper repair does not require compound to make it leak proof.

Locks and laces are being peened with an air hammer.

Repair is completed. If it leaks peen lightly with air hammer.



Length and position of crack is determined with magnetic unit.



Slot is cut in crack with saw attachment to drill.

Repairing Cylinder Head Cracks

The "Seal-Lock" process permits repairing cracks between cylinder head valve ports and/or nozzle hole. To do this, first remove valve seat insert if any. Then clean cylinder head and valve port free of varnish and carbon. Let's assume crack is between valve port and nozzle hole.

Determine the length and position of crack with a magnetic inspection unit if possible, then center punch along the crack.

Next, align the Seal-Lock saw so that the middle of the blade is centered between the nozzle hole and the valve port. When proper alignment is obtained, any drill may be used to operate the saw. (A ¼-in. electric drill with ⅜-in. chuck 1700 rpm is recommended.)

Measure the slot length and cut a metal strip from the kit 3/16-in. longer. The strip should have a press fit of 0.007-in. plus or minus 0.003. A few drops of oil on each side of the strip will lessen the tendency of the strip to bend while being hammered into position. The strip should have an equal amount of metal in the valve port and nozzle hole.

Trim excess metal with a small chisel leaving about 1/16-in. for peening. Under cut valve seat leaving about 1/16-in. for clean-up on both OD and depth cuts. For example, for a valve seat of 2⅛-in. OD make cut 2 1/16-in. OD; and for a valve seat depth of ¼-in. make depth cut 3/16-in.

Drill lock patterns so that all holes are the same depth. Usually a depth of slightly less than two locks is sufficient. The pattern is drilled into the valve seat angle, under-cut at about 45 deg. The first hole is drilled into the strip. Using this hole as a guide for the dowel on the lock pattern jig, the remaining four holes are drilled. (Two holes on each side of the hole drilled in strip)

Next, hammer the locks in. Use a hand-punch corresponding in size to the drill used in making the lock pattern to upset each lobe of the lock individually as it is placed. The last lock should protrude slightly above the pattern holes.

Peening should start with the locks, then the face of the cylinder head, the nozzle hole and finally the valve port.

After replacing the valve seat, place the emery cloth sleeve on the drum furnished in the kit and dress off excess metal from the repair.

In most cases the Seal-Lock saw can be used to saw out the crack between valve ports in cylinder heads. If not, the lock and lace method is used.

Metal plate for block blowout hole is cut to match template.

After laces are peened, locks are inserted and peened.

After metal in slot is peened, lock patterns are drilled.

Repairing Casting Blowout

To repair casting blowouts, first smooth off the ragged edges of the blowout hole with a grinding wheel.

Make a template by placing a piece of cardboard over the hole, lightly tapping the edges of the hole with a small ball-peen hammer.

Using scrap metal, cut out plate to match template. The repair plate is then placed in blowout hole. It should be a press fit but a loose fit can be overcome by shimming.

Secure the plate in place by drilling, tapping and inserting one tapered lace on each side of plate where it joins the casting. The laces are screwed in tight and clipped off ⅛-in. above the face of the casting.

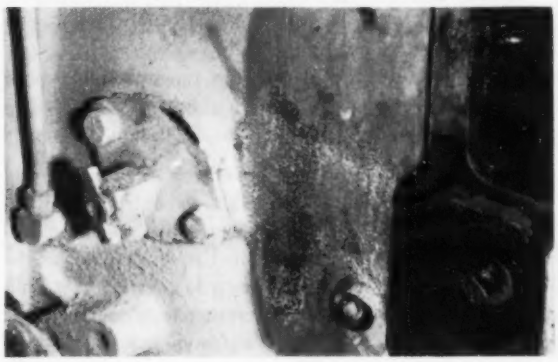
Seal the opening around the edges of the plate by drilling completely through the opening at the plate and casting and tapping each hole with a Sealace tap. Each lace should bite into the adjoining lace, making a tight seal then clipped off ⅛-in. above the face of the casting.

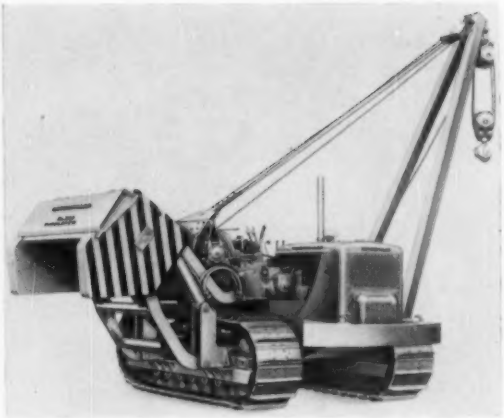
Peen the entire area where the laces have been placed. Then dress off the repaired area with a grinding sleeve or disc.

Next drill the patterns. Start ½-in. from the corner of the repair area and drill through ¾ of the thickness of the casting using the lock-spacer for spacing the lock patterns.

Insert the locks and upset them with an air hammer. Then dress the excess metal off and light peen the entire repair.

Excess metal is dressed and entire repair is lightly peened.





86,000-lb Capacity Stable Cat Pipelayer

NEW pipelayer by Caterpillar Tractor Co. combines 86,000-lb capacity at 4-ft overhang and an 86-in. wide track gauge for dependable footing. Ground clearance of 19 in. gives maximum maneuverability.

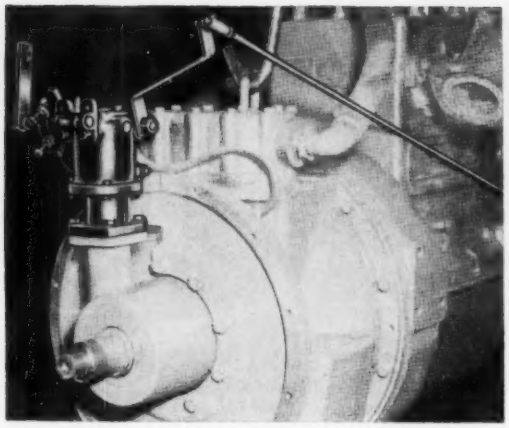
A 4-cyl Cat diesel, rated 128 hp at 1200 rpm, powers this No. 572 medium-sized unit. The engine transmits power to a 3-stage torque converter, coupled with a special low-speed transmission having three forward and two reverse speeds. This low-speed, pressure-lubricated transmission is designed to provide slow speeds necessary for pipelaying work. Access to transmission is gained by removal of box construction center section of pipelayer frame.

For extreme stresses of this heavy operation, the machine's design includes integrated unit construction of tractor chassis and pipelaying mechanism. Further weight-carrying ability is provided by the extra heavy-duty track rollers—six on each side.

In-seat starting is provided on the No. 572 unit, utilizing an independent 2-cyl, 4-cycle gasoline engine with 6-v electric starter.

This pipelayer supplies constant full power to the boom and load lines whenever the engine is running. Power for the winches comes from a live-shaft, constant power take-off direct from the engine, independent of the torque converter and flywheel clutch. The pipelayer winch has its own clutch and transmission.

Rear of the No. 572 has been left clear to facilitate draw-bar work. Fifteen positions are available on the unit's swinging drawbar. This gives versatility to work with any type of towed or rear-mounted equipment.



This direct-driven mechanical governor is mounted on the torque converter housing. It is pressure lubricated through an oil line from the converter. Oil drains to converter sump.

Governing Torque Converter Output Speeds

Recommendations on tailshaft governor selection, mountings, drives, linkages and couplings for best performance.

EVEN when load on a torque converter varies, constant output shaft speed is demanded in some applications. To do this, the governing device must be driven by the output shaft. Hence the need for a tailshaft governor which senses variations in output shaft speed rather than engine speed.

The Pierce Governor Co. has designed three basic model tailshaft governors to economically meet specific requirements of torque converter applications. These models with their many variations are readily adaptable to different installations. However several factors must be considered in selecting the correct governor.

Governor Installation

For example, it is recommended that a long range variable-speed governor be considered as a standard for all applications. The long range type governor gives regulation over a wide range of tailshaft speeds. It can also maintain any desired speed in that range. Standardization on the long range type governor reduces the number of models and the engineering time required to establish new installations.

Mounting And Drive—Mounting and metl od of driving the governor generally depend on provisions available on the converter. Most converters have provisions for mounting the governor on the converter and for driving the governor with either a belt or directly with a gear, tongue or spline.

For the direct-drive types, a standard four-bolt mounting is used in almost all converters. In either case, the governor location is established by the converter design. This makes it doubly important that governor installation be considered during the design stage so that interference problems may be solved in the most satisfactory and economical way.

Pierce direct-driven governors for torque converters are basically symmetrical in design. They permit rotation of the governor in increments of 90 deg. to meet varying installation requirements without a major change in governor design. They're pressure lubricated through an oil line from the converter. Oil drains through the governor base into converter sump.

Some converters provide a tachometer outlet which is used to drive the governor through a heavy-duty flexible cable. The flexible cable, though costly, permits the governor to be located near the engine fuel control system. This is especially desirable on installations requiring complicated or excessively long linkage to reach the fuel injection pump.

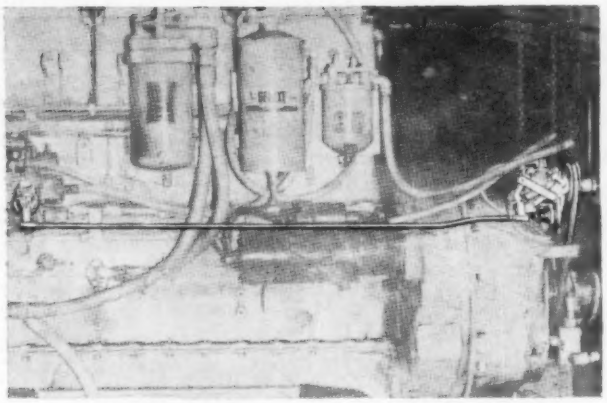
Cable-driven governors are provided with a two-bolt bracket-type mounting flange. Due to the wide variation in mounting brackets required, the bracket on the converter must be supplied by the customer.

The belt-driven governor is for use on torque converters which have no provision for driving the governor directly. Although the belt drive has some limitations, field use has proven it is a satisfactory and dependable means of driving the governor. Belt-driven governors are provided with a two-bolt bracket-type flange. Due to the wide variation in mounting brackets required again the bracket must be supplied by the customer.

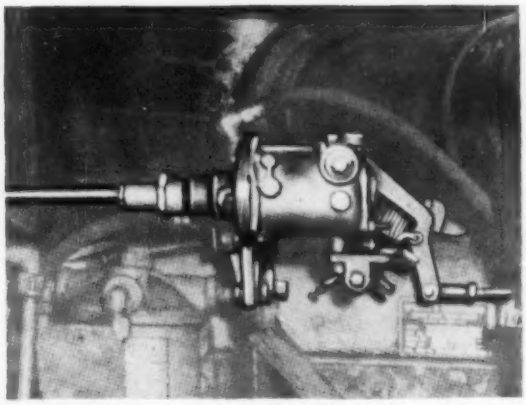
Manual lubrication is standard on all belt-driven models. If pressure lubrication is required, a ¼-in. pipe top must be specified for the oil drain.

All three models are of the long range variable-speed type governing through a 3-1 ratio of tailshaft speeds. Top governor speed should not be over 4500 rpm.

Linkage—Mechanical-type governors depend entirely upon the energy of the weight system to control the engine throttle. The broad speed range over which governor control is desired provides very limited weight energy at the lower end of the range. Therefore it is essential that linkage design get adequate consideration to obtain satisfactory governor performance. Friction in linkage must be



This Pierce mechanical tailshaft governor is belt-driven from pulley on converter output shaft. Note straight linkage from governor to fuel injection pump. Linkage should be as short and light as possible.



A mechanical tailshaft governor can be located near the engine fuel control system when it is driven through a heavy-duty flexible cable. Complicated or long linkages are eliminated.

reduced to a minimum to avoid dissipation of the available weight energy.

The ideal linkage is a short straight rod with heavy-duty adjustable ball joints at each end. Where the length of linkage is so great that rod weight becomes a factor, thin walled tubing should be used in place of a rod.

Use of transfer bellcranks in linkage system should definitely be avoided. When properly engineered with anti-friction bearings at all pivot points they are very costly. Even under these conditions each transfer bellcrank introduces three additional points of friction to be overcome by governor energy. Furthermore, wear and normal dirt accumulation at the pivot points increase friction rate and reduce governor performance ability.

Coupling—The most effective coupling is to connect the linkage to the speed-change bellcrank of the diesel engine governor. This provides very satisfactory control of tailshaft speeds and uses the engine governor as an overspeed device. Bellcrank travel must not exceed the specified travel of the torque converter governor. Likewise, the force required to operate the bellcrank must be held within the limitations of the torque converter governor.

Governor Calibration—Lag between the time that an increase in engine speed is registered on the tailshaft is an inherent torque converter characteristic. To compensate for this condition the torque converter governor must have very stable regulation characteristics. Governor calibration must provide enough energy to control the engine throttle without exceeding the structural limitations of the governor.

Basic calibrations can be supplied by Pierce engineers when given the speed range required and the drive ratio of an application. Final calibration is determined by actual test of a completed unit.

Overspeed Protection—The torque converter governor senses only output shaft speed and controls the engine throttle accordingly. Therefore, the engine must be protected with an overspeed device which senses engine speed and limits that speed to a safe maximum. This protection may be obtained with three types of governors: mechanical; electric; and vacuum velocity.

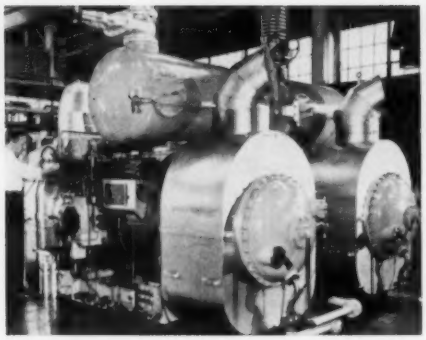
Mechanical—Most industrial engines have a mechanical governor as accessory equipment or have provisions for installing one.

Electric—The electric overspeed governor is basically a mechanical governor having a switch which is actuated by the governor when an overspeed condition is reached. Switches are available for all common voltages in normally open or normally closed circuits and with provisions for either manual or automatic resetting. The switch operates through a relay to shut off the diesel fuel supply.

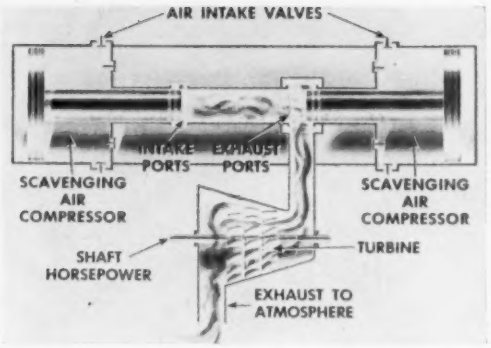
Models are available which may be driven by gear, belt or flexible shaft. They may be supplied with a mounting bracket or with two- or four-bolt mounting flanges for installation on standard mounting pads. These governors may be calibrated to operate at speeds ranging from 1200 to 4000 rpm. But speeds from 1800 to 3000 rpm are most desirable. Provisions are made for either manual or pressure lubrication. Pre-lubricated models are also available.

The electric overspeed governor offers overspeed protection that is positive and dependable. In addition there is an advantage in the simplicity of installation. The governor is readily installed near the drive source and all interferences are easily overcome with the simple wiring circuit to the relay for diesels. This relay acts to cut off fuel and shut down the engine.

Vacuum Velocity—When using this type governor it is essential that it be adjusted for a speed well above the maximum required to obtain the complete range of output shaft speeds. This is to prevent interference with the torque converter governor.



Two of six gassifiers as installed aboard the Liberty Ship conversion.



Schematic of components and showing gas flow to turbine during exhaust.

GM's Free-Piston Engine-Turbine Applied in Marine Service

A NEW propulsion technique is featured in the Liberty Ship "Wm. Patterson" conversion to free-piston engine gas-turbine power. The 6000 shp unit, developed and tested by the Cleveland Diesel Engine Div. of GM, combines some of the features of a diesel with those of the gas-turbine.

Conversion of the 9000-ton vessel is part of the Maritime Administration's program to increase the efficiency, economy and performance of US cargo ships. Bethlehem Steel Co. Shipbuilding Div. at Baltimore is making the conversion, Lykes Brothers Steamship Co. will operate it.

According to T. E. Hughes, manager of Cleveland Diesel, their marine propulsion application of a free-piston engine gas-turbine drive is a first in many respects. Some of these are: it is the first Marine installation of its kind in this country; it is the largest marine installation to date, supplying 6 gasifiers on a common piping system; and the turbines, as applied to date, are the largest in rating having internal direct reversing wheels.

Outstanding features of the free-piston gasifier are:

1. Power stroke every cycle—like a 2-cycle diesel.
2. No valve gear—valves are automatic, like those of an air compressor.
3. Uniflow scavenging—compares to an opposed piston engine.
4. No crankshaft—no rotative external power is generated.
5. No connecting rods—there is no crankshaft to connect to the pistons.
6. No main and connecting rod bearings.
7. No balancing out of rotative torsionals, couples, etc. Reciprocating masses are statically balanced by weighing the pieces.
8. Due to the high compression ratios, high compression temperature and high scavenging, all with high thermal efficiency, the engine handles heavy fuels very satisfactorily.

Based on 8.54 lb of gas per second going to the turbine at 44.4 psi, 850°F, each gasifier delivers 1233 gas hp at 41% thermal efficiency. Overall turbine efficiency is 85%, and piping losses are 1½-2%. On actual test evaluation reduction gear losses are 3%.

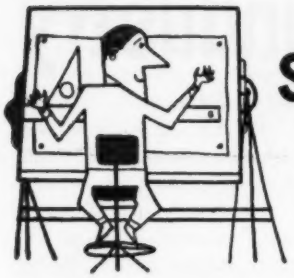
The engine consists essentially of a two-cycle diesel with opposed pistons rigidly connected to the compressor pistons. Their work is transmitted directly to the compressor pistons. The engine pistons are of equal and symmetric stroke with the power cylinder between them.

The single acting compressor cylinders are located on both ends of the center housing and are inward compressing. End spaces constitute the cushion chambers which store energy for the return stroke. Air pressure in the cushions is automatically controlled by means of a mechanism called the stabilizer which gives a compression pressure suited to a given power.

The two reciprocating masses are connected by a mechanical linkage which equalizes any slight force differences due to friction, wear and intake air pressure. This synchronizing gear in no way limits the stroke of those pistons. Oscillatory motion of the linkage actuates the fuel injection pump.

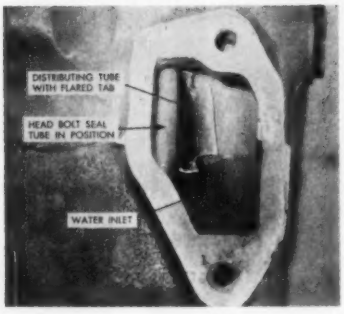
Fuel is injected by means of an accumulator-type fuel injection pump. Starting is accomplished by introducing a fixed quantity of high pressure air into the cushion air spaces.

In operation, an air-fuel charge is ignited between the opposed pistons in the cylinder. The pistons spring apart, compressing air at both ends of the cylinder. This compressed air makes the pistons "bounce" back to cylinder dead center. This "bounce" forces compressed air into the scavenging chambers for the next cycle and also forces hot combustion gases from the cylinder into the turbine. The hot combustion gases flowing into the turbine cause it to rotate and deliver horsepower through its shaft to the ship's propeller.



service section

Recent engine and equipment modifications, procedures and recommendations straight from the different manufacturers to you



IH Improved Cylinder Head

To improve coolant circulation in production cylinder heads used with model U-372, U-406, U-450, and U-501 engines, the first three water openings in the cylinder head water wall have been closed. This increases circulation to the rear cylinders. This reduces the possibility of cylinder head cracking in the No. 5 and No. 6 combustion chambers, valve burning and piston scoring.

Some cylinder heads have been made with the first three water openings between the head bolt tubes closed. They can be identified by visual inspection through the coolant inlet opening at the front of the cylinder head. These heads are satisfactory and incorporate the improved circulation now used in the new cylinder heads.

However, the majority of the cylinder heads have the three openings in the front of the water wall. To improve circulation in these heads it will be necessary to install a water distributing tube.

The distributing tube is 20½-in. long and is designed to direct the flow of coolant to the rear cylinders.

With installation of a new head having openings in the water wall, the new distributing tube must be installed. Any cylinder head removed as a result of valve failures or piston scoring with the openings in the water wall must also have the distributing tube installed if found to be free of cracks.

(*Continued on Page* 87)

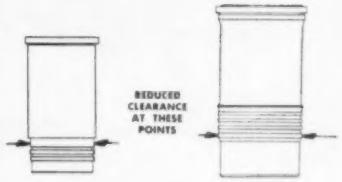
Cat's Common Lube Oil System For Diesel and Starting Engines

A common lubricating oil system is now used between the vertical starting engine and the diesel engine on D7, D8, D9, DW15, DW20, DW21, Tractors, No. 583 Pipelayers, D326 (Series F), D337 (Series F), D339 and D342 Engines.

The new system uses the same oil to supply pressure oil to the starting engine and diesel engine. It provides oil for the starting engine bearings when either the starting engine or the diesel engine is operating.

A standpipe in the starting engine pan maintains an oil level in the starting engine to provide lubrication in the usual manner when only the starting engine is operating.

Conversion groups are available to adapt the common lubricating system to some earlier machines in the field.



Cummins H, NH and J Liners

H and NH lip-type liners have been improved further by increasing the outside diameter of the pilot just below the packing rings. This change reduces wear of the block at the liner counterbore and packing ring areas.

The improved liners are standard in all H and NH engines beginning with engine serial No. 136650.

Similarly the lower pilot diameter of cylinder liners for all J Series engines has been increased beginning with engine serial No. 140816.

Part numbers for all liners have not been changed except for the letter "X" which has been added for identification.

Torquing Bolts on GM "71" and "110" Engines

The bolts that retain the various assemblies together both in and onto the engine have been picked especially to do their particular job. Both the SAE Handbook and the GM Engineering Standards have many pages devoted to bolt and nut specifications.

In these specifications, bolts are grouped into grades ranging from grade 0 through grade 8. The grade-0 bolt has no special requirements as to tensile strength whereas a grade-8 bolt will have a tensile strength of 150,000-psi. Bolts usually have mark-

(*Continued on Page* 87)

news of our industry

Midget PIE Rig Tours for Safety

Contrasted here with giant B-36 bomber is PIE's "Mighty Mite". This scaled-down model is one-half the size of their diesel line haul rig. It has toured all 48 states. It's mission—promotion of safe driving. Inside the midget trailer is a full set of safe driving testing equipment. Thousands of high school students have taken driving tests and been given safety training by Pacific Intermountain Express representatives en route from coast to coast.

IH Power Behind Baseball Bats

Here International U-264 unit is the power behind the process of batting out stock for bats. Split ash logs are cut to 3-in. diam stock—2000 of them every eight hours. That's a lot of famed "Louisville Sluggers", some of which are destined for our baseball greats.

The IH unit powers equipment for the complete operation: two 30-in. circular cut-off saws, 42-in. bolting saw, Defiance 40-in. gang lathe and 24-in. blower-type fan.

Engineer Aides Prettier These Days

Thanks to the Business Training College, more engineering secretaries come equipped with more brains—and beauty, too. These are the first three students to graduate from the intensive training in engineering know-how. It's the only such course in the country. Much needed graduates are, left, Patricia Shafley, James W. Sneddon and Kay Jack shown with Dr. Dorothy C. Finkelhor, founder of the school.

Next year, 22 juniors will get their diplomas. They, like these first graduates, will be proficient in engineering terminology, physical science, chemical experiments, slide rule, drafting, blueprint reading, visual aids and, of course, secretarial skills.

Engineers everywhere need trained aides to ease their work load. And what busy boss will object when they're also easy-on-the-eye.

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organizational news . . Page 72

new literature . . . . Page 74

Safe Motor Operation Studied by Fleet Executives

About 100 executives from 12 states took an intensive five-day course in safe and effective motor fleet operation at the University of Maryland. They represented supervisors from most every type company operating a fleet of motor vehicles.

The comprehensive program included class, laboratory and field instruction. Subjects covered driver selection and training; personnel records; safety; driver-customer relations; accident cost and investigation; employee relations; law enforcement and court procedures, and equipment maintenance.

Mack Moving Ahead

For two years, Mack Trucks, Inc. have been busy expanding. Now they're negotiating additional financing to keep up with projected potential business, reports P. O. Peterson, president.

Mack will move along as the highway building program proceeds. Their market will broaden, too, as people and industry continue moving to new communities. These outlying sections usually depend on highway transportation. They need trucks, buses and fire apparatus.

Expansion at Mack has already had results. Their sales are up 13%. Earnings up 33% gave them the best first quarter in history.

Oil Hydraulics Summer Course

A course in basic oil hydraulic power will be offered June 10-21 at Illinois Institute of Technology, Chicago. Designed for shop, operating, maintenance and sales personnel in industry, the course provides training in a well-equipped laboratory with equipment supplied by the hydraulic industry.

Areas to be treated include fundamentals of fluid mechanics, properties of hydraulic fluids, piston and rotary type pumps, rotary hydraulic transmissions, reciprocating and rotary hydraulic cylinders, piping, JIC control valves, basic factors of circuit design, basic circuit descriptions and circuits applied to automatic machine operation.

James W. Owens, Jr., *Manager* (right), and Howard W. Clutts, *Superintendent*, of the M & A Electric Cooperative Plant, at Poplar Bluff, Mo., point with pride to one of the Young Intercooler-equipped engines in their prize winning plant.

Young COOLERS serve REA Prize Plants for 6th Straight Year!

Once a champion—always a champion! Perhaps that is why the M & A Electric Cooperative found it easy for their Green Forest Plant, at Poplar Bluff, Mo., to repeat as Division B winner in the annual competition for efficiency among REA internal combustion plants.

And speaking of champions—count Young equipment in that class. For the sixth straight year Young cooling equipment has been an important part of the award winning plants. This year Young Intercoolers aided both the Poplar Bluff plant and the Division A winner—Thumb Electric Cooperative, Ubly, Michigan—to achieve the coveted honor for their Caro plant.

It just goes to prove—*where quality counts*—you'll always find Young heat transfer equipment!

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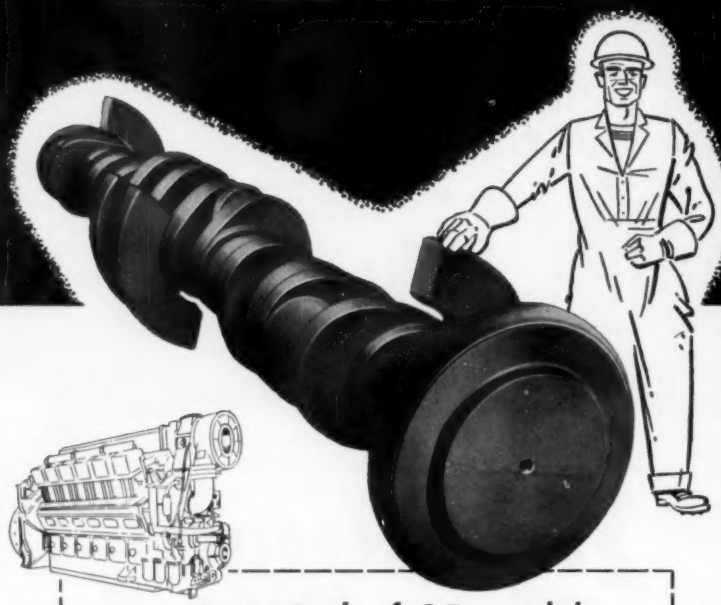
WASHINGTON
Seattle—Harlan C. McKay Company
WEST VIRGINIA
Charleston—Industrial Equipment Company, Inc.
Clarksburg—Jones & Laughlin Steel Corporation

THIS PARK DIE-FORGED CRANKSHAFT WEIGHS 3500 POUNDS



. . . is typical of 25 models from 1500 to 5000 pounds, made for diesel and gas engines

This "six throw" crankshaft, almost 12 ft. long, is representative of the large die-forgings Park supplies to manufacturers of gas and diesel engines.

Park's facilities include a complete die-sinking shop, modern specialized heat-treating equipment and experienced metallurgical and engineering staffs.

Our sales engineers will show you how Park die-forgings can increase strength and safety—cut down size and machine time on your requirements.

Die Forging Specialists Since 1907

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news of our industry

One-Year Test Okays 5000-kw Power Plant

This railway-mounted gas-turbine power plant, designed by Westinghouse Electric Corp., has just logged over 5000-hr operation. At the end of the one-year test, the power plant was shipped to the U. S. Army Engineering Depot, Marion, Ohio, where it is now held on a stand-by basis.

One of the two 54-ft long railway cars contains the 5000-kw turbine-generator with exciter, a 150-hp wound rotor starting motor and turbine auxiliary control panels.

The second car houses a 6250-kva outdoor transformer, a 150-kw diesel generator, a 50-kw diesel generator, 30-kva transformer, high and low-voltage switchboards, remote turbine control panel and auxiliaries, such as air-conditioning equipment, heaters, batteries and 4-kw axle driven generator.

Cars can be easily converted for use on most any gauge track in the world. Westinghouse states the power plant will start and operate in tropical and arctic climates and requires no additional equipment for operation beyond a fuel supply.

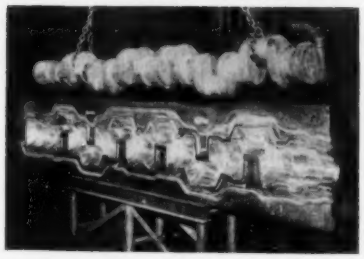
High Safety Record Throughout GM Plants

General Motors in 1956 achieved the best safety record in its 49-year history and earned its 12th "Award of Honor" in the past 15 years, the National Safety Council has announced.

Of GM's 500,000 employees in the United States and Canada, 99.8% lost no working time during 1956 because of occupational illness or on-the-job accident.

Harlow H. Curtice, GM president, pointed out General Motors spends about $30,000,000 annually on accident prevention and health maintenance to assure the best possible safety program. And they get results.

news of our industry



Heavyweight Closed-Die Forgings

Crankshaft forgings for diesel locomotives weighing up to 5000 lb are being turned out by closed-die forging at Park Drop Forge Co. This one is a 3500 lb multiple throw crankshaft,—one of a lot made with two Heppenstall Hardten die blocks, each 16 in. high, 31 in. wide and 159 in. long and weighing 22,518 lb each. Many hours of precise machining were required to "sink" the dies.

Park Drop Forge is now installing a new 50,000-lb capacity hammer, one of the largest, they claim, used for production of closed-die forgings. The company also has 25 other hammers ranging from 2000 to 35,000 lb.

For the past 20 years, this firm has been producing the majority of closed-die forgings which are considered to provide more accurate and better forgings. When quantity is great enough to justify the cost of dies, economies in production of forgings result.

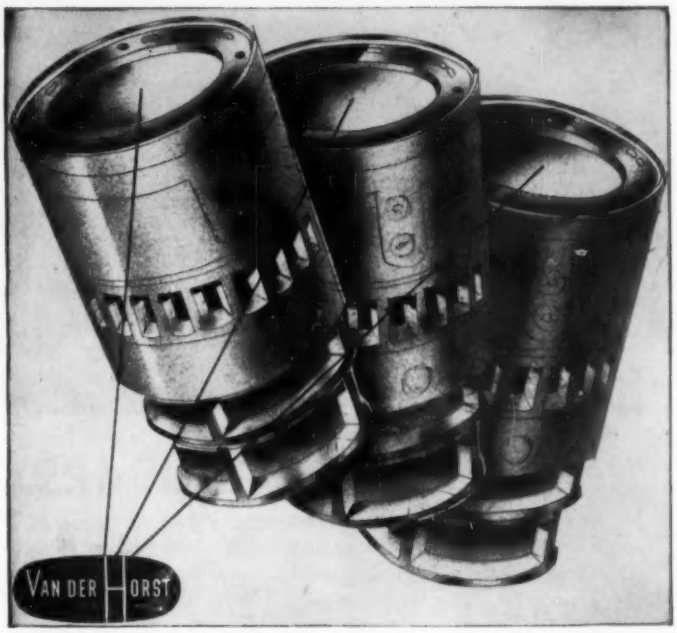
Turbocharged Diesel Trucks Delivered to Miles & Sons

Miles & Sons Trucking Co., Merced, Calif., have added 43 more Kenworth trucks to their fleets. All have Cummins NT-6-B turbocharged diesel engines delivering 250-hp.

Five Kenworth Model 925, with insulated aluminum tanks, will spread hot oil at northern California locations. Twenty Model 521 cab-beside-engine units will be operated with doubles on dry-freight hauls between Ukiah and San Diego. Sixteen Model 921, also used with doubles, will haul cement and aggregate throughout California.

(Continued on Page 76)

5 *big advantages of*



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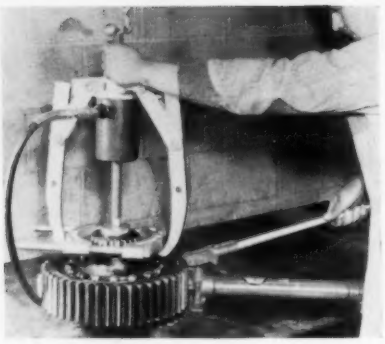
new products



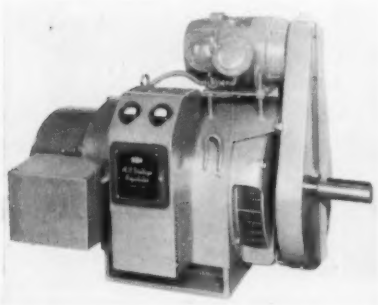
Generator Designed For Offshore Use

Electric Machinery Mfg. Co. has developed a generator for offshore use with two important new features, but with standard drip-proof construction. It incorporates top-mounted belted exciter. Explosion-proof, the exciter is electrically connected to the generator with explosion-proof fittings. A primary spark-producing part of the generator is thus explosion-proof and isolated.

Also, collector rings are completeenclosed in heavy cast steel. Any collector ring arcing is confined to the enclosure and thus the secondary source of sparking is isolated.

The enclosed collector ring housing has another obvious advantage. It limits the corrosive effect of sea air on the brass rings. So life of collector rings comes closer to that of rings in normal atmosphere.

The machine is used for offshore drilling rigs both as primary source of power and to power auxiliary systems such as mud reclaiming equipment.



Compact Heat Exchanger

This plate-type oil cooler offers high lube cooling capacity for transmissions, torque converters and other units. Developed by Long Mfg. Div., Borg-Warner, this heat exchanger is now in production for use on marine and truck engines.

Plate shells enclosing the mild steel turbulators are formed from stampings of solid cupronickel. The lubricant flows through the plates in the opposite direction from the water circulating about them in the casing. This assures maximum heat exchange efficiency. Current applications extend to 400 btu per min.

For more data on this compact heat exchanger, just check the post card in the back of this issue.

Hydraulic Pulling Tool

Being used here, at left, for quick removal of a tapered roller bearing, is new 20-ton Blackhawk Holl-O-Ram hydraulic ram. Also available in 30- and 60-ton capacities, the rams have seven pulling attachments for pulling gears, bushings, sheaves and other tight-fitting shaft-mounted parts.

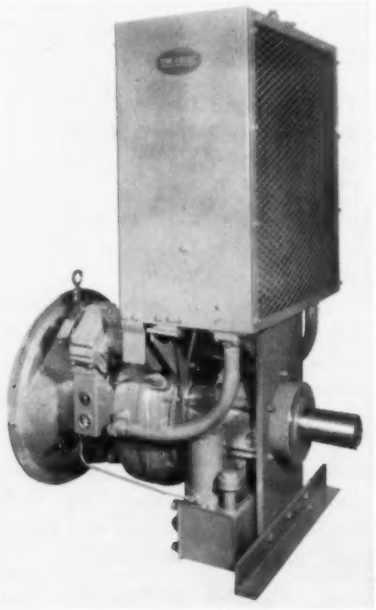
Holl-O-Rams, Blackhawk states, exert torque-free, smooth hydraulic power with tons of pressure under precise finger-tip control. Thus, they save downtime and are easy on expensive machine parts.

Heavy-Duty 3-Stage Torque Converter

Higher capacity version of Twin Disc 11,500 Series 3-stage torque converter has been announced by Twin Disc Clutch Co., Hydraulic Division.

This heavy-duty unit has a maximum rating of 586 hp at 2200 rpm. Impellers are available for specific torque ratings of 340, 390, 450 and 540 lb-ft. Maximum input torque is 1400 lb-ft.

Current production units include Model CF which provides a clutch at the flywheel, and Model F which is connected to the flywheel with a driving ring. Both are designed to SAE No. 0 flywheel housings.



Exhaust Snubbers For Turbocharged Engines

Shown here are exhausts from six Clark Model TLA gas engine-compressors at Durango, Calif. This is the outside of one of 13 stations of the Pacific Northwest Pipe Line running from New Mexico to Washington. All are equipped with new turbocharged type engine-compressors. In turn, each engine is equipped with exhaust snubbers, specifically developed by Burgess-Manning for silencing turbocharged engines.

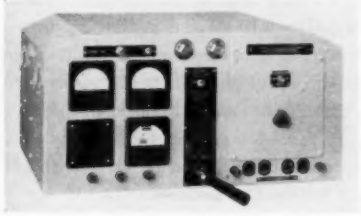
The new snubbers are of straight-through type which Burgess-Manning says has a very low pressure drop and is quite effective in reducing the exhaust noise of these engines.

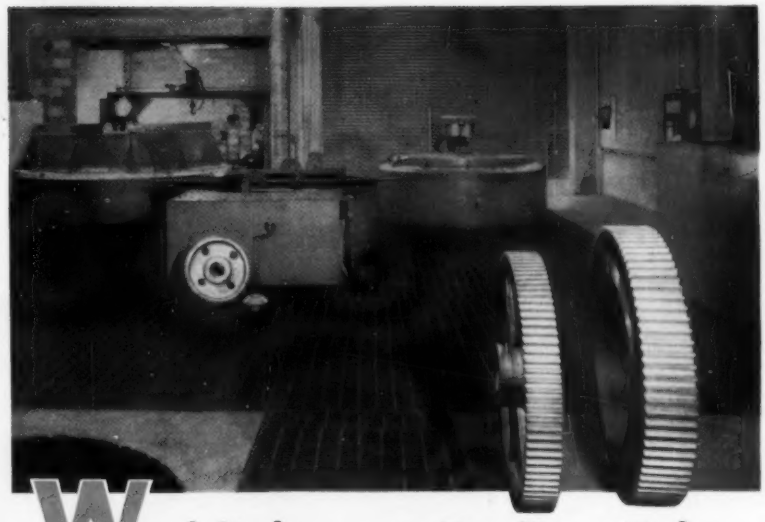
Diesel Generator Controls

For use with stationary and portable diesel generator sets, Lake Shore Electric announces a wide capacity range of voltage output controls. Three types are available—top mount shown here, wall mount and "S" utility models.

Service ranges are 20 to 187 kva with dc 2- and 3-wire; ac single-phase and 3-phase dual voltage. While Regohm regulators are standard on all controls, Lake Shore offers option of five other voltage regulators—Simplex, Westinghouse, General Electric, Allis Chalmers and Brown Boveri.

All controls are harness wired, tied and taped with numbered leads. Quality construction includes use of vibration-dampening pigtails at circuit breaker, transformer and voltage regulator, the firm states.





World's largest Radiant Tube Pit-type Carburizer installed at BRAD FOOTE

...more precise heat treatment for larger gears

• New heat-treating equipment, including the largest radiant tube pit-type gas carburizing furnace ever built, has recently been installed in the Pittsburgh plant of our subsidiary, Pittsburgh Gear Company. These new additions to BRAD FOOTE's extensive heat-treating equipment provide facilities for the most advanced techniques in deep case carburizing and hardening in controlled atmospheres.

• The new carburizer can handle gears or machine parts up to 6 feet long, 6 feet wide and up to 8500 pounds in weight. In addition to its size, the new equipment has an unusual ability to control carbon penetration, giving extremely precise control of the depth of surface hardening.

• Special heat-treating equipment, like this new carburizer, allows BRAD FOOTE to impart the precise metallurgical characteristics which make for longer wear, shock resistance and freedom from distortion in gears of all sizes and types. And BRAD FOOTE heat-treating is under the supervision of metallurgists with long experience in the special problems of the gear industry.

• Whether you want one gear or ten thousand, BRAD FOOTE's extensive facilities and specialized skills are at your disposal. Send us the specification on your next problem job for quotation. No obligation, of course.

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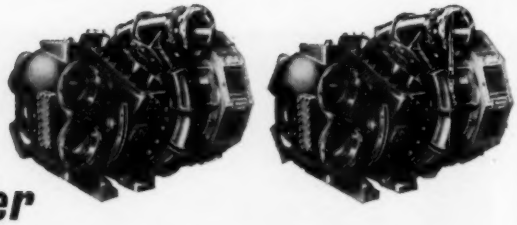
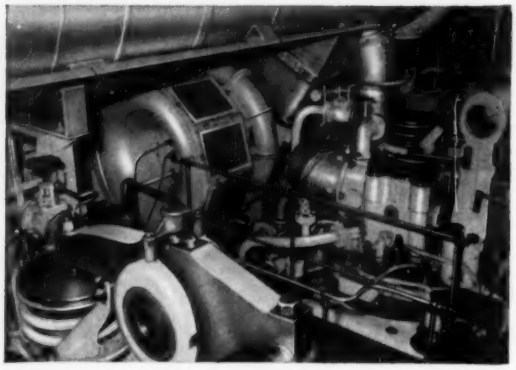


These Napier Turbo-blowers were chosen



for this engine

Two Napier Type MS 600 turbo-blowers are fitted to the Burmeister & Wain 6-cylinder single-acting two-stroke diesel engine which powers the Compagnie Maritime Belge (Lloyd Royal) M.V. LUSAMBO. This Burmeister & Wain engine was made under licence by S. A. Cockerill and Ougrée in Belgium. The ship is one of three which have Burmeister engines with *Napier* turbo-blowers. Why were *Napier* turbo-blowers chosen? Here are three good reasons:

- Napier blowers have *high adiabatic efficiency*, resulting in maximum power increase and low fuel consumption.
- Journal bearings on the MS 500 and 600 Napier blowers are sleeve type, and with proper lubrication they will last as long as the engine itself. The MS 500 and 600, the largest blowers in the Napier range, are built especially for marine applications.
- A high standard of workmanship is guaranteed by Napier's long experience in precision engineering.

Napier turbo-blowers are available in seven sizes for engines of 140-4,000 h.p. afloat and ashore. Multiple installations for engines of higher powers. On 4-stroke diesels they can double the power, on 2-strokes they increase it by over 30%—often at a lower specific consumption. Napier turbo-blowers are currently in use in 69 countries.

which powers this ship

NAPIER Turbo-blowers

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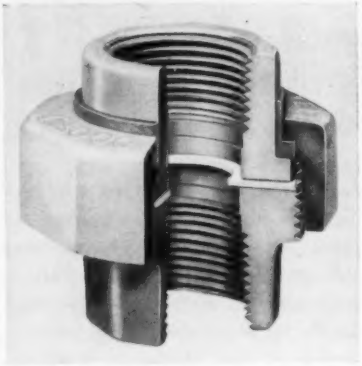
CRC T14

new products



Insulating Union For Diesel Piping

Insulating forged steel unions which isolate stray currents along diesel pipe line are announced by W-S Fittings Div. The unions are made in 3000-lb class, sizes ¼ in. to 3 in, both screw-end and socket-welding types.

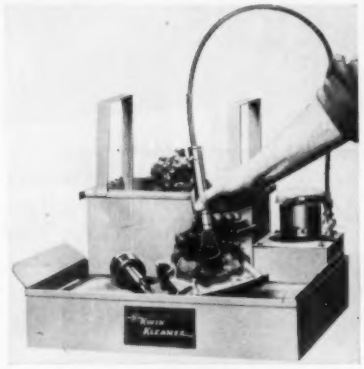
Tailpiece, thread piece and nut are drop forged from carbon steel meeting ASTM material specification A-105 Grade 2. The insulating sleeve separating the tail piece and nut is made of fabric-reinforced phenolic resin, noted for its strength and chemical resistance. The gasket, sealing the union joint, which is in contact with the fluid, is of Teflon. It is completely inert to most chemicals, W-S claims, and has good heat resistance and insulating properties.

Millivoltmeter For Corrosion Surveys

Bristol Co. announces a self-contained, portable millivoltmeter for corrosion survey work, involving measurement of voltage and current. Such surveys are useful in engineering cathodic protection systems for pipe lines and tank forms.

The millivoltmeter recorders are offered with movement sensitivities of either 2000 or 10,000 ohms per volt. Each instrument is equipped to measure over eight ranges, each of which is self-contained and available for use by turning a tap switch. It records on an 8-in. diameter, carbon-coated chart. This Bristol weatherproof unit can be used for long term continuous records, since it can be left unattended for up to one week.

new products



Small Parts Cleaner

Kwik-Kleaner, made by Nielsen Saw & Mfg. Co., is a new small parts cleaning machine which pumps solvent through a brush handled by the operator.

The 20-in. by 20-in. unit has a built-in pump, soak tank, lift-out basket and fountain brush. Tank holds parts as large as 12 in. by 20 in. With basket, tank can be used for small parts or as an injection parts cleaner using a special fluid. Nylon brush loosens foreign matter which pressurized cleaner washes away. Flow of cleaner can be adjusted from a trickle to a flood. The cleaning fluid is filtered and recycled again and again.

High Heat and Pressure Hose

Flexible Teflon hose assemblies are being marketed by Flex-O-Tube Div., Flexonics Corp. They are constructed of smooth extruded Teflon tube covered with stainless steel wire braiding.

The new hose is designed to withstand working pressures up to 3000 psi. When working pressures are not above 1000 psi, the hose will withstand temperatures to 500° F. Flex-O-Tube states the hose retains high flexibility and resists chemicals, oils and corrosives at elevated temperatures.

Both straight and elbow fittings as well as special shapes are available.

For more details on any of these products, just fill in the postal card in the back of DIESEL POWER.

(*Continued on Page 78*)

ACCURATE,
CONTROLLED,
Timed
LUBRICATION
The New 82-V vacuum pumping unit "with dry sight feed," an exclusive Manzel development will end your liquid sight feed problems. Install them on any existing Manzel lubricator. Now — more accurate than ever . . . it will pay you to get complete detailed information on this dependable, field-proven Manzel unit.
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A Division of Houdaille Industries, Inc.

organizational news

New Product Section At American Bosch

An Advanced Engineering Section has been set up at American Bosch Div. of American Bosch Arma Corp. This is in line with the concern's expansion program.

Heading the new section is Joseph C. Johnson. He will concentrate on new product concepts to assure growth of the division. Mr. Johnson, an SAE member, comes to this post from Titeflex, Inc. where he managed research and development.

Joseph C. Johnson

W. B. Prosser

D. H. Teetor

Perfect Circle Names Officers

Donald H. Teetor, vice president of Perfect Circle Corp. for the last 11 years, is named chairman of the board. He succeeds his brother, Lothair Teetor, who will continue as a director of the company.

Also elected is William B. Prosser as president to succeed Ralph R. Teetor remaining as a director. Herman C. Teetor is appointed a vice president. Re-elected are Daniel C. Teetor, vice president and George Rea, secretary-treasurer.

Deluxe Products Move

The Sales Dept. of Deluxe Products Corp. has moved from La Porte, Ind. to 1201 Michigan Blvd., Racine, Wis. O. M. Hoyt, marketing manager, has been transferred to the new Racine headquarters.

Joins Erie Forge

William A. Merriman has joined Erie Forge & Steel Corp. as manager of casting sales. For eight years he was with Allegheny Ludlum Steel and for nine years with Pittsburgh Steel Foundry.

William H. Merriman

REBORE CONNECTING RODS IN YOUR OWN SHOP

New GREENLEE PRODUCTION MACHINERY

HYDRO-BORER

Assures precise alignment. Accurate to .0003" T.I.R. Fast precision boring.

Quick, easy setups. For any size rods. A money-maker in every engine shop.

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STURTEVANT TORQUE WRENCHES

Read by Sight, Sound or Feel

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- Automatic Release
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in inch grams
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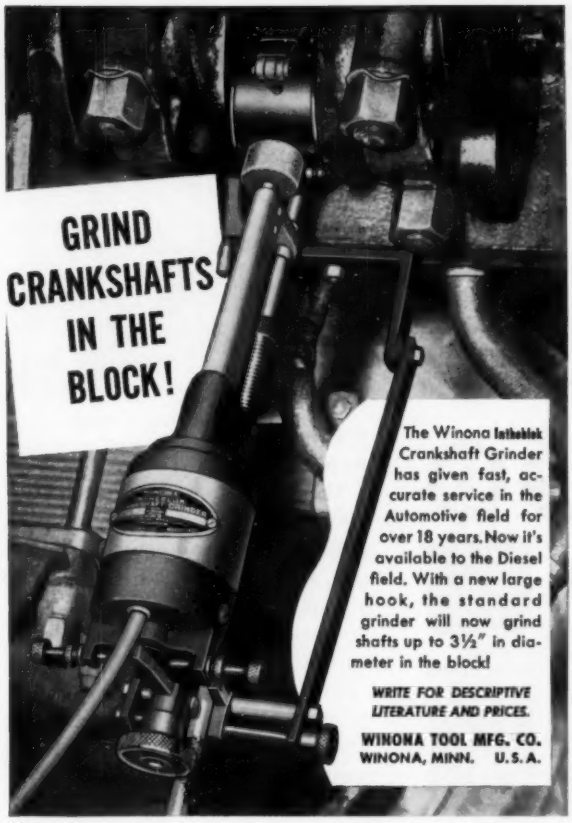
...foot pounds

Every manufacturer, design and production man should have this valuable data. Sent upon request.

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS


GRIND
CRANKSHAFTS
IN THE
BLOCK!
The Winona Lathelok Crankshaft Grinder has given fast, accurate service in the Automotive field for over 18 years. Now it's available to the Diesel field. With a new large hook, the standard grinder will now grind shafts up to 3½" in diameter in the block!
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WINONA TOOL MFG. CO.
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KIENE®
DIESEL
indicator valves
OPERATES AT PRESSURES UP TO 10,000 PSI
Kiene valves have effective gas seal both open and closed without packing or glands. Operate against pressure — will never blow open. Small and rugged — 4¼" in length with only 3¼" circle of space for attachment. Kiene valves give better service under the most severe conditions. Standard indicator plug and wing nut connection.

Furnished with male ½" NPT engine connection. Other threads on order. Adaptations for most diesel locomotive engines.
SEND FOR BULLETIN V-10
KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

organizational news

Joins Kelite Staff

John A. Mowrer has been named equipment product manager, western region, for Kelite Corporation.

Mr. Mowrer will be responsible for steam cleaner sales in 12 western states. Before this he was with Marquette Mfg. Co.

Elliott Appointment

Charles L. Hoebel shifts tc post of district manager of the New York office of Elliott Co. A graduate in mehanical engineering from Worchester Polytechnic Institute, Mr. Hoebel joined Elliott in 1952 as field engineer.

Charles L. Hoebel

Flexonics Announcement

James L. Cullen has been made asst. sales manager, Hose Division of Flexonics Corp. where he plans to establish a national distributor organization for Flex-O-Tube products. Mr. Cullen has been with this manufacturer since 1951.

John MacGuffin

Briggs Sales Manager

John D. MacGuffin has been made sales manager of Briggs Filtration Co., Washington, D. C. He succeeds H. K. Woodward who takes over as administrator of the eastern region of Bowser, Inc. Bowser is the parent company of Briggs and 13 other subsidaries and divisions.

R. K. Annis

Fairbanks, Morse Transfer

Fairbanks, Morse & Co. announces the transfer of R. K. Annis to Chicago as development engineer. Mr. Annis was formerly assistant manager of the company's Kansas City Works.

Reid-Holcomb Opens New Branch

Reid-Holcomb Co., Inc., distributors of Detroit Diesels, has opened a new Evansville, Indiana branch. The office will carry Reid-Holcomb's line of construction and petroleum equipment.

Heading the facility is T. W. Hamlin. John Sauter is service manager and Max Farrar is in charge of the parts department.

(Continued on Page 80)

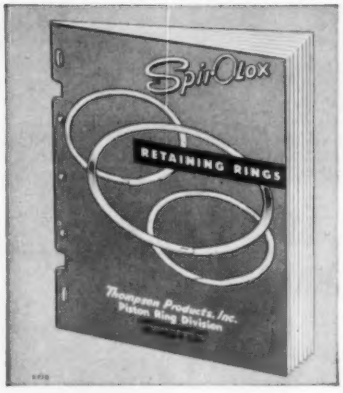
new literature

Camshaft Bearing Troubles?

Off-beat treatment is accorded the latest booklet by Dura-Bond Engine Parts Co. With a light touch "The Case of the Perfect Fit" tells the virtues of its camshaft bearings and the "crimes" they prevent. Ask for your copy of this entertaining but instructive piece on the reply card in the back of this issue.

For Tractor Operators

Two new manuals for operators of Eimco Model 105 tractor-excavators, covering over-head and front end loader types, have been prepared by Eimco Corp. Each offers tips for efficiency in operation and preventive maintenance to extend the equipment's usefulness. Safety precautions are also emphasized.



Retaining Ring Application Manual

Thompson Products, Inc. has issued its 1957 catalog for Spirolox, gapless, 2-turn, coil action retaining ring. In the new edition are 20 pages of application and specification data for standard sizes and special designs. Text and pictures show how Spirolox coil spring action expands or contracts to position or lock pinions, bushings, bearings and other moving parts on shafts and in housings. Their use eliminates nuts or other locking and positioning devices.

Advantages cited for Spirolox are savings in weight, space, parts, machining and assembly time. Copy of this catalog can be requisitioned on post card in the back of DIESEL POWER.

IH Diesels

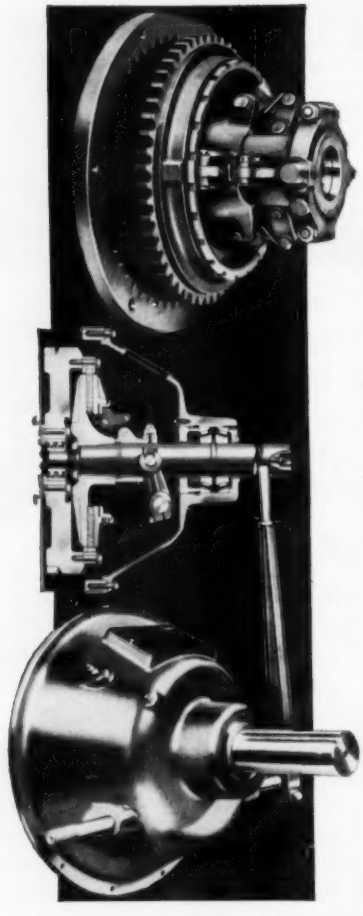
International Harvester has a new leaflet on its line of 16 power units. Specifications for three 6-cyl and three 4-cyl diesels, and six 6-cyl and four 4-cyl carbureted units are given.

The folder shows units powering various machines such as packing plant compressor and water well drilling rig.

Micro-Fine Filter Tubes

Technical data on the use of honeycomb filter tubes for micronic clarification of liquids at various temperatures, has just been published by Commercial Filters Corp. They are made in a variety of natural and synthetic fibers. Details are given on filters for fuel oil, diesel, lube oil and other petroleum products. Recommendations for type of fiber to use for specific conditions are included.

ROCKFORD

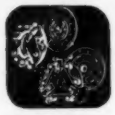


POWER TAKE-OFFS are UNDER RATED

*ROCKFORD POWER TAKE-OFFS are designed for generous overload capacity, when the standard length shaft is used and the center of the load is placed at a point half way along the shaft extension. The proportions of the shaft and bearings are determined by the load capacity of the clutch selected.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.


Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

ROCKFORD Clutch Division BORG-WARNER

1301 Eighteenth Ave., Rockford, Ill., U.S.A.

Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

CLUTCHES

new literature

Buying a Battery?

then you'll want to review the pointers in "So You're Going To Buy an Industrial Battery" put out by Gould-National Batteries, Inc. It covers proper selection for the job, correct charging and handling, systematic maintenance and the value of continuing knowledge of battery condition.

The booklet also cites case histories of battery problems and solutions. Requisition your copy of this interesting guide on the post card in this issue.

Over-Temperature Protection

An electric thermostat which provides over-temperature protection in commercial, laboratory and industrial equipment is described in a new bulletin by Robertshaw-Fulton Controls Co.

When the Model H14 thermostat is tripped, the over-temperature cut-out remains open until reset manually. It is a double-pole, single-throw, direct-acting thermostat.

Applications, wiring and mounting diagrams are included.

Aluminum Bus Conductor Uses

Anyone responsible for engineering and maintenance of bus installations, will want the 280-page book published by Aluminum Co. of America. This Aluminum Bus Conductor Handbook contains 69 graphs, tables and pictures presenting essential data in useable form.

It covers the uses and properties of aluminum as a conductor. Chapters deal with conductor shapes, design, reactance, capacities, deflections, joints and short-circuit conditions. The wealth of data winds up with the all-important fundamentals of installation.

In addition, this comprehensive book contains a bibliography of technical articles for exploration of related subjects.

For your copy of any of this data, use the postage-free card in the last section of this publication.

Tips on Longer V-Belt Life

Simple precautions to prolong the life of V-belts and increase drive efficiency are contained in a new 12-page bulletin by Allis-Chalmers Mfg. Co.

The piece tells how to select and match various types of V-belts. It also lists seven steps for the correct installation belts and offers as many hints for making them last longer. Although published by A-C, the data is applicable to all types of V-belts manufactured today.

Flexible Connectors

Flexonics Corp. has released a bulletin on Flexon flexible connectors for pumping installations. It gives information on how to absorb vibration, dampen noise, reduce piping failure and prevent leakage. Material specifications, pipe sizes and fitting connections are shown along with operating pressures and maximum off-set allowed. A diagram pictures proper installation procedures.

(*Continued on Page* 82)

SPECIALLY ENGINEERED FOR DIESEL ENGINE REBUILDING SERVICE

TOBIN-ARP MFG. CO.
Announces the NEW

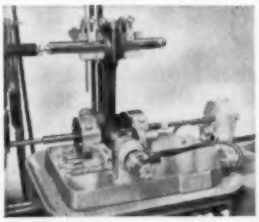
PM 900D PIN FITTING MACHINE

SPECIALLY ENGINEERED TO PRECISION BORE

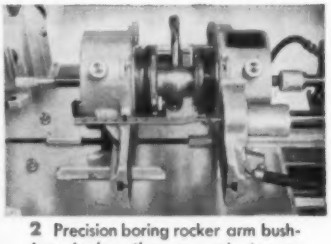
- √ CONNECTING ROD BUSHINGS
- √ CAM LEVER BUSHINGS
- √ ROCKER ARM BUSHINGS

The PM 900D is a precision boring machine—capacity 21/32" to 2⅜". Connecting rod capacity 23". Boring capacity can be increased to 4⅛".

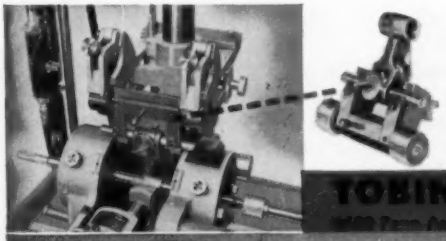
A TAMCO PRODUCT



1 Precision boring piston pin bushing parallel with crank pin bore, to specified center-to-center dimension.



2 Precision boring rocker arm bushings in *less than one minute* per rocker arm.



3 Precision boring cam lever bushings, parallel with roller shaft to specified center-to-center dimension, with Vernier Scale Control.

Write TODAY for complete information!

TOBIN-ARP MFG. CO.

5164-GS-B
164-pc tool set
$34.45 down
only $7.07 a week

Snap-on

PACKAGED WORKSHOP

puts the right tool at the mechanic's finger tips

Rush your repair jobs and break downtime bottlenecks with this basic kit of *Snap-on* tools. Mechanics like its space-saving compactness. You'll like its timesaving completeness that puts the right tools on the job with the repair crew.

The 164 tools in the all-metal carrying case are basic for everyday operation . . . will handle hundreds of shop and field maintenance jobs. It's an excellent selection for on-the-job servicing of diesel or gasoline engines, material handling equipment, cars and trucks, plant utilities, factory machinery. Socket sizes range from 3/16″ to 1-1/4″ in 1/4″, 3/8″ and 1/2″ square drives. Boxockets 5/16″ to 1-1/4″, open ends 7/32″ to 1″.

Make sure the mechanics in your shop see this advertisement. Many other compact, timesaving *Snap-on* kits and tools are also available. Your *Snap-on* man can give you specialized tool service and recommend the best tools for your needs. Write us or call your nearest *Snap-on* branch.

Prices subject to change without notice.

SNAP-ON TOOLS CORPORATION
8064-F 28th Avenue • Kenosha, Wisconsin
*Snap-on is the trademark of Snap-on Tools Corporation.

news of our industry

(*Continued from Page 67*)

Incentive for Better Customer Relations

Here's a good idea for fostering improved customer relations. Each year Oakite Products honors the man who has done the best customer relations job. John Mackesy is 1956 winner of the Distinguished Service Award.

The award has nothing to do with sales volume. It's given for efforts beyond the ordinary in helping industry get the most for its cleaning and metal-treating dollar.

We repeat—it's a good idea.

Diesel Sales by Fairbanks

Eighteen diesels were reported sold by Fairbanks, Morse & Co. during the past month. They ranged from a high of 3500 hp down to 5¼ hp.

Among the largest were a 12-cyl, 2000 hp Model 38D8-⅛ non-reversing marine diesel engine bought by RTC Shipbuilding Corp., Camden, N. J. Another 12-cyl Model 38D8-⅛ basic diesel delivering 1920 hp was purchased by Comision Federal de Electricidad, Mexico City. City of Falls City, Nebraska ordered a 10-cyl, 3500-hp Model 31AD18 dual-fuel generating unit.

Engine-Gear Sets For Pipeline Compressors

Twenty Nordberg Supairthermal engines with built-in step-up gears are being shipped to gas pipeline pumping station sites. One engine a week is the schedule for assembly, test and shipping which has been attained by the production force at the Milwaukee plant.

Eleven 16-cyl vee engines, each rated 3550 bhp at 550 rpm, are now being installed in three stations of the new Westcoast Transmission Co. Ltd.'s gas pipeline in British Columbia.

Nine more 3550-hp engines will be shipped to stations of the Transcontinental Gas Pipeline Co. which runs from east central Texas to New York. Three of the engines will be installed at Station #23 near Houston. The first Nordberg spark-ignition engine-gear set for gas compressing service has been in service there since December, 1955.

news of our industry

SAE Summer Session

June 2-7 was the date of the SAE National Summer Meeting in Atlantic City. Thirty-nine technical papers were presented. Here are some of the subjects discussed:

"System of the MWM Balanced Pressure Precombustion Chamber for High-Speed Diesel Engines;" "European Developments in Small Aircooled Engines;" "Aspects of the Automotive Gas Turbine for Military and Commercial Vehicles," and "The Future of the Diesel Engine in Commercial Vehicles."

Brazil Orders Gas Turbines

Four 5000-kw gas turbine-generator units have been ordered from Westinghouse Electric International Co. by the state of Sao Paulo, Brazil. The four units, valued at about $4-million, will begin operating in 1958 at a new power station at Votuporango, and another plant at Juquia, supplying electricity to small cities in a 50-mile radius.

Gas turbines were selected, they point out, because of serious water shortage and a desire for mobility. Later on the Juquia power units can be moved elsewhere to tie in with a major transmission network.

"Mechanical Mule" Handles Navy Blimps

Navy blimps are being docked and undocked by a new 4-wheel drive vehicle affectionately dubbed the "Mechanical Mule." These take the place of the strings of men that used to tail on the handling ropes.

"Easy does it" is the slogan in handling such lighter-than-air craft and so the vehicles require special equipment. An Allison TC-554 converter supplies a smooth flow of power to a large reel for taking up on the mooring lines. Also, through a TG-618 transmission, it provides motive power for the vehicle. Smooth, quick shifts are needed so as not to jerk the retrieving lines.

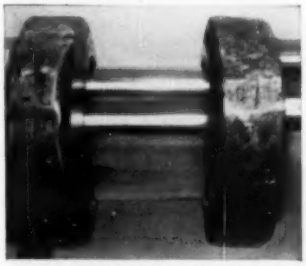
For maximum mobility in docking and undocking the blimps, both front and rear wheels turn for "crab-like" travel. The Navy and Goodyear Aircraft designed the tractor and American Coleman Co. builds them.

THIS CRANKSHAFT JOB NEEDS A SPECIALIST

This is specialized work, rebuilding crankshafts—intricate, exacting, and naturally expensive. It's the kind of work that demands a specialist . . . and we are just that!

We've specialized in rebuilding crankshafts, because since 1916 we've *made* crankshafts. And who knows better than a maker what are the "musts" of a sound, economical repair job. We'll take your worn crankshaft and rebuild it, if salvagable, through the carefully controlled steps of grit blasting, replating, regrinding and thorough inspection. And we'll deliver it back with a guarantee for 100% performance that only a manufacturer-specialist can provide. May we quote on your next job?

For more details on crankshaft repair write for Bulletin RC-3



This is a finished, repaired crankshaft, after processing by National Forge.

NATIONAL FORGE AND ORDNANCE COMPANY

Irvine (Warren County), Pa.

new products

(*Continued from Page 71*)

Double-Action Cleaner

For maintenance cleaning jobs, Antiox-Type-R is the new corrosion inhibitor and safety solvent cleaner developed by Peneton Co. The company points out as the formula performs its degreasing job, it deposits a protective coating against corrosion and rust. The coating is colorless, transparent, dry, non-tacky and non-toxic.

Versatile Gasket Cutter

Latest gasket cutter by Garlock Packing Co. is used for cutting round gaskets from asbestos, rubber, fibre or cork sheets, and for precision scribing and layout work.

Hexagonal-shaped bar with six-sided face provides positive gripping surface for knife and point holders. The tool is adjustable to cut gaskets 1¼-in. to 22¼-in. outside diameters. Center point and knife holders can be mounted on a bar for cutting larger gaskets.

Battery Trickle Charger

Automatic Switch Co. offers a new low-cost battery trickle charger with continuous adjustment range of 50 to 200 mil amp. The Asco charger includes a meter to indicate charging current; output is fused to protect charger components. Output voltages are 12 and 24 v dc with input voltages of 110 v to 120 v, 60 cycles. Terminal blocks are marked for input and output connections. A full wave selenium rectifier circuit is provided.

Corrosion-Resistant Thermostat

For controlling heat in corrosive applications, Fenwal, Inc. has added a new thermostat fabricated entirely from 316 stainless steel. For greater corrosion resistance, all exterior joints are heliarc welded.

The Thermoswitch coupling-head mounting has a ½-14 pipe thread for direct threading into tank or pipe wall. Contacts open above the control setting. Control temperatures are adjustable over a range of −100° to +400° F.

FOCUS ON DALIC

Solutions for:
BISMUTH
BRASS
CADMIUM
CHROMIUM
COBALT
COPPER
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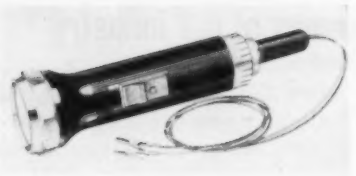
GOLD
INDIUM
IRON (PURE)
LEAD
NICKEL
PALLADIUM
PLATINUM
RHODIUM
SILVER
TIN
ZINC
and a wide range of alloys

RECLAIMING A DIESEL BEARING

Dalic is an electro-deposition process with an accurately controlled and high rate of deposition. The anode pad, soaked in a cleaning pickling, plating or stripping solution is moved evenly over the surface to be plated, which is made the cathode. Deposits have low stress, extremely fine grain, perfect adhesion and complete absence of porosity. Dalic is particularly suited to plating selected areas without masking, parts that are difficult of access or which it is undesirable to dismantle or immerse in a plating solution and for plating to fine tolerances without further machining.

Re-depositing the tin/lead alloy on a diesel bearing (operating time 3 minutes)

DALIC METACHEMICAL LIMITED
121 JUDGE ROAD TORONTO CANADA



Continuity Tester Flashlight

Here's an extremely useful lamp for maintenance men to test continuity of wiring circuits. Put out by Ray-O-Vac, the N227 continuity tester combines a Workman flashlight with special end cap and detachable tester. The tester has a jack to plug into the flashlight end cap.

Jack and wire leads are heavily insulated and positive spring grip clips are used to make contact. The lamp lights when a continuous circuit is tested. When the circuit is broken or defective, of course, it does not light. For straight flashlight use, simply remove the jack from this inexpensive unit.

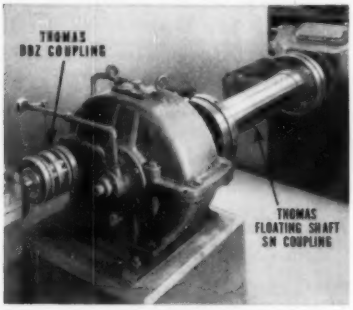
Chrome Plating Additive

Of interest to those chrome plating diesel liners, crankshafts and other engine parts, is a new liquid addition agent developed by Wagner Bros. Called Krome-On, the company states it gives greater covering power, less waste of chromic acid, safer working conditions and reduced operating costs.

Lightweight, Flexible RR Truck Developed By GM Ltd.

To meet growing railroad demands for locomotives having light axle-loads, General Motors Diesel Ltd., has developed the "Flexicoil" truck, which reportedly reduces the total truck weight and also provides a fully flexible truck for main line and branch line operation. The truck consists of a one-piece cast frame with a separate independent bolster, slightly smaller than the bolster pocket which permits lateral movement but can be controlled by snubbing mechanisms. The spring arrangement (two coils over each journal box) gives a considerably softer ride. Over 60 units having "Flexicoil" trucks are now in Canadian service and 84 more are on order, according to a GM spokesman.

THOMAS
FLEXIBLE COUPLINGS
Give You Freedom From Coupling Maintenance



NO LUBRICATION

NO MAINTENANCE

NO WEARING PARTS

Future maintenance costs and shutdowns are eliminated when you install Thomas Flexible Couplings. These all-metal couplings are open for inspection while running.

They will protect your equipment and extend the life of your machines.

Properly installed and operated within rated conditions, Thomas Flexible Couplings should last a lifetime.

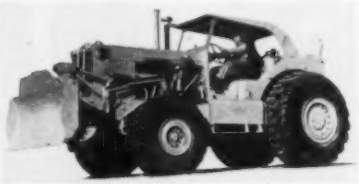
UNDER LOAD and MISALIGNMENT ONLY THOMAS FLEXIBLE COUPLINGS OFFER ALL THESE ADVANTAGES.

1 Freedom from Backlash Torsional Rigidity
2 Free End Float
3 Smooth Continuous Drive with Constant Rotational Velocity
4 Visual Inspection While in Operation
5 Original Balance for Life
6 No Lubrication
7 No Wearing Parts
8 No Maintenance

Write for Engineering Catalog 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

new products



Four-Wheel Drive Diesel Tractor for Rough Terrain

M-R-S Mfg. Co. is producing a four-wheel drive version of its 335-hp M-R-S 200 tractor. It is powered with a Cummins NPT-6-B1 diesel.

With ample power, a static weight of 45,500 lb and large, low-pressure tires, the large tractor can provide up to 38,200 lb tractive effort. A semi-automatic transmission is employed, giving the tractor nine forward and two reverse speeds. Maximum forward speed is 35.18 miles per hr.

M-R-S recommends this tractor as a prime mover to self-load scrapers up to 20-cu yd struck capacity and for powering scrapers up to 30-cu yd when loaded with pusher assistance.

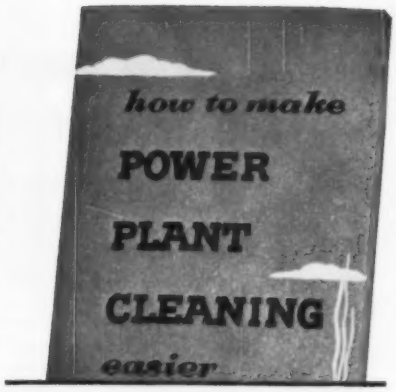
Detroit's Turbopower Twins

The construction industry is demanding more and more power in smaller packages. To meet this need, Detroit Diesel Engine Division, GM, has introduced its first multiple turbopower unit. Official unveiling took place on June 14 at the Oklahoma Semi-Centennial Exposition.

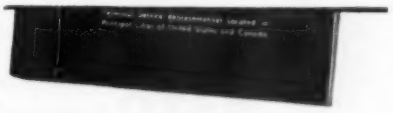
The new unit consists of two Series "71" 6-cyl turbopower engines. They are mounted on a common base and drive a single output shaft similar to engines Detroit Diesel first introduced to Oklahoma oil fields in 1945.

Addition of a single-stage, free-turning centrifugal exhaust turbine to the efficient Series "71" engine lowers fuel consumption yet gives more hp per lb. The impeller boosts intake air pressure and reduces load in the engine-driven blower. The result, Detroit Diesel says, is twice the air box pressure for more complete combustion and scavenging.

Increased horsepower is attained with very little increase in size and weight. The unit has a basic engine rating of 472 hp at 2100 rpm.



Your Guide To Diesel MAINTENANCE CLEANING



Here—in this new Power Plant Cleaning Guide—you will find one money-saving suggestion after another to help speed up your diesel overhauling and reconditioning work. Here, for example, are described the most modern, most effective procedures for:

- **Soaking hard carbon deposits off aluminum pistons**
- **Removing rust and scale from diesel cooling system**
- **Cleaning filters**
- **Desludging lube oil coolers**
- **Degreasing parts before repair**
- **Steam-detergent cleaning**
- **Stripping paint**

And saving time and money on many other important maintenance operations.

A FREE copy of this informative booklet will be mailed promptly on request. No obligation. Write Oakite Products, Inc., 22C Rector Street, New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING
OAKITE
MATERIALS • METHODS • SERVICE

Technical Service Representatives in Principal Cities of U. S. and Canada

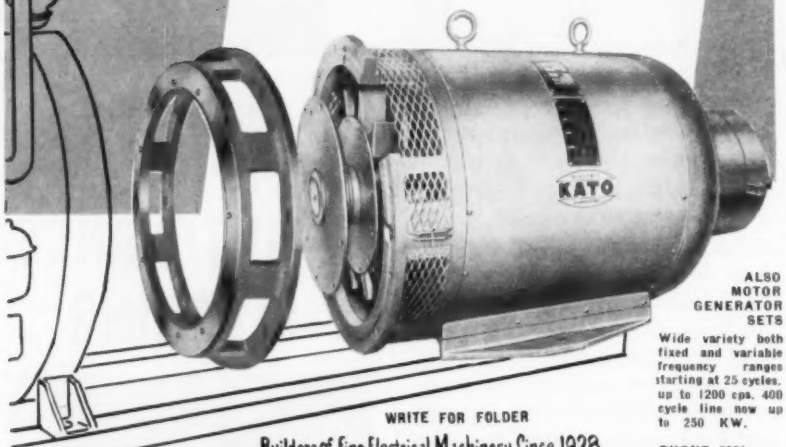
KATO GENERATORS

Fit The Engine Of Your Choice!

CHOICE OF FLEXIBLE COUPLINGS

Adaptable to ALL ENGINES with SAE Bell Housings

There is a size in the Kato line of generators with the electrical characteristics to meet your specific requirements. By means of one of Kato's flexible steel, disc-type couplings, as illustrated, Kato generators easily connect to any diesel or gasoline engine. All standard frequencies . . . 25, 50, 60 and 400 cycles, plus many special frequencies to 1200 cycles (both fixed and variable). Now 400 cycles to 250 KW. 60 cycles to 500 KVA. One or two bearing designs. Extra lead wires brought out insure a maximum voltage selection.



ALSO MOTOR GENERATOR SETS

Wide variety both fixed and variable frequency ranges starting at 25 cycles, up to 1200 cps. 400 cycle line now up to 250 KW.

WRITE FOR FOLDER

PHONE 5031

Builders of Fine Electrical Machinery Since 1928

SPECIAL ORDERS WELCOMED

KATO Engineering Company 1408 First Ave. Mankato, Minnesota

BRIGGS OFFERS YOU, FREE, A 16 PAGE MANUAL ON OIL FILTERS AND METHODS OF INSTALLATION

HERE is a big 8½" x 11", file size, 16 page, fully illustrated booklet. It's brimful of technical data and drawings that every designer and operating engineer will want to read or keep for ready reference. Write for your copy. No obligation.

Briggs OIL FILTERS

FILTER/SEPARATORS

YES! THE BRIGGS FILTRATION CO., DEPT. 180, WASH. 16, D.C.
AT NO COST or obligation, send me the above booklet

Name .....

Company .....

Address .....

organizational news

(*Continued from Page 73*)

Elected by Ashland Oil

New vice president at Ashland Oil & Refining Co. is Franklyn M. Moffitt. In his new capacity, Mr. Moffitt will have charge of sales of aviation, railroad and industrial fuels and lubricants, petro-chemicals and other petroleum specialties. Mr. Moffitt joined Ashland in 1940.

A-C Sales Drive

Allis-Chalmers is going all-out for more construction machinery sales. They've established a new department which will devote full time to development of dealers and their sales organization. Heading up these growth activities is V. M. Holloway. He first came to A-C back in 1937 as a tractor training student.

J. M. Haile will take over the former job of Mr. Holloway as asst. sales manager of the Construction Machinery Division.

Another A-C promotion is that of K. A. New who succeeds Mr. Haile as eastern territory manager.

V. M. Holloway

Burgess-Manning Promotions

W. A. Carroll, Jr. has been advanced to general sales manager of Industrial Silencer Div., Burgess-Manning Company. He will be located in the Dallas office.

R. T. Oliver will replace Mr. Carroll in his former post as New York district sales manager.

W. A. Carroll, Jr.

organizational news

Power Specialty Co. Names

Walter J. Verlander as manager of its newly established New Orleans office. Mr. Verlander spent many years with A. M. Lockett & Co., Ltd. in the application and sale of power plant, petroleum and petro-chemical equipment.

IH General Manager

Now heading the Construction Equipment Div., International Harvester, is C. A. Hubert. Mr. Hubert first joined IH in 1937 as engine designer at the Tractor Works, Chicago.

Farris Product Manager

First step in expansion move of Farris Pickering Governor Co., Inc. is the appointment of Joseph S. Dale as product manager.

He brings to his new post 17-years experience gained at Woodward Governor and Dale Hydraulic Controls. This background will be utilized in plans for development and application of an expanded line of governors.

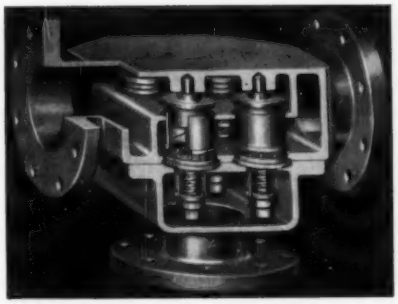
Joseph S. Dale

Cummins Election

N. M. Reiners, who has been with Cummins Engine Co., Inc. for 20 years, was elected vice president of research. Among other positions Mr. Reiners has served as design engineer and technical analyst for Cummins.

All other Cummins officers and directors were re-elected.

N. M. Reiners



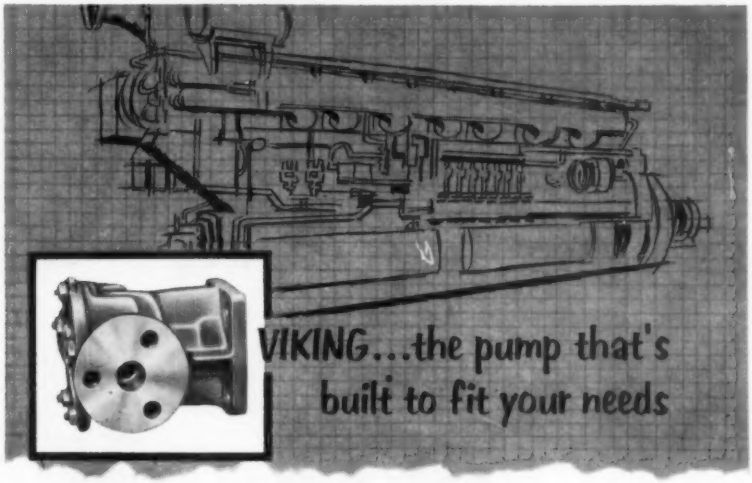
BE SURE WITH

AMOT

JACKET WATER & LUBE OIL THERMOSTATS

SAFETY	Provided for by multiple independent elements as shown above.
√	Provided for by rugged AMOT element construction. No AMOT element has ever stuck closed since its introduction 6 years ago. Many years of "know how" are built into every AMOT element.
√	Omission of all hand operators means engine temperature is safe from tampering by engine attendants. AMOT is the only engine thermostat that can be considered safe without a hand operator.
√	Lack of capillary tubes, bulbs, and packing glands means no failures from kinks or leaks.
SERVICE	There is only one replaceable part—the element. Renewal of element renews all working parts. Element replacement, if ever required, is several times faster than on any competitive make. Original accuracy of temperature setting is always provided in element replacement.
√	AMOT engineers are available in most major cities to help on application and other problems.
√	Most models are available from stock for rush orders.
MODELS	½" to 6" pipe sizes. Larger sizes in iron, bronze or ductile iron.

AMOT CONTROLS CORPORATION • FIRST ST. & NEVIN AVE. RICHMOND, CALIFORNIA



Whatever your needs in a pump . . . whether it's bearing lubrication, coolant or fuel delivery . . . there is a Viking Pump in the size you need—2/3 to 1050 GPM.

If you want a pump to fit your equipment, Viking will furnish the right pump. More than 750 catalogued models are available, PLUS special units. If you need special pumps, take advantage of Viking "know-how", based on experience in designing thousands of special pump installations.

For more information, write for Catalog 57Sd today.

VIKING PUMP COMPANY

Cedar Falls Iowa U S A In Canada it's "ROTO-KING" pumps

See our Catalog in Sweet's Industrial Construction and Plant Engineer's File

new literature

(*Continued from Page 75*)

Electrolytic Iron

Industrial uses of Vanderloy electrolytic iron are legion. Some pictured in a new Van der Horst bulletin are: to reclaim worn or mis-machined parts, to protect soft metals or fragile metal forms and to provide a surface with a high affinity for tinning.

Van der Horst states its 99.9% pure iron has 75,000 psi tensile strength, 60,000 psi yield point and 225 Brinell hardness.

Metalworking Lubrication

In preheating and forming, do you have trouble with oxidation or gas absorption by alloy steels, titanium or other metals? Then you'll want the new chart prepared by Acheson Colloids Co.—"Dispersions for Industry". It tabulates 44 colloidal and semi-colloidal dispersions.

Included are carriers and diluents, applications and physical data for graphite, molybdenum disulfide and many other materials.

This condensed factual leaflet will put metalworking lubrication facts at your fingertips.

C.A.V.

Depots and Service Agents in over 100 Countries

FUEL INJECTION EQUIPMENT DIVISION
of
LUCAS ELECTRICAL SERVICES, INC.
Head Office: 653 Tenth Avenue, New York 36, New York
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West Coast: 5025-29 W. Jefferson Blvd., Los Angeles 16, California
Canadian Distributors:
Joseph Lucas (Canada) Ltd., Head Office: 11 Davies Avenue, Toronto 8, Ontario
Branch Office: 3401 St. Antoine Street, Montreal 30, Que.

A.P. 174817

Assembling Hose Fittings

Parker Appliance Co. offers instructions in assembling non-skive Hoze-lok fittings to rubber covered, wire braid hose. The two simple steps are described on a handy card to hang on the wall.

Continuous Discharge Centrifuge

For diesel installations burning heavy fuels, De Laval Separator Co. has a bulletin which tells how Model AC-VO Nozzle-Matic centrifuge recirculates fuel to reduce loss. This heavy fuel oil purifier can be supplied with a special sludge recirculation device. This feature recirculates the discharged solids back into the bowl for further centrifugation—assuring maximum solids concentration with maximum recovery of the liquid phase.

Worm Gear Drives

Cleveland Worm & Gear Co. discuss worm gear drives and their application to mechanical power transmission in a new booklet. It is a useful summary of data on the standard line of speed reducers, worm gear sets and custom-designed units put out by Cleveland.

Considering the power transmitted and the ratio of reduction, worm gear units are quite compact. They point out, also, the right-angled shaft arrangement saves floor space by placing the motor and reducer in line, parallel to the driven machine.

Over and Underground Performers

The entire line of International Harvester units is pictured hard-at-work on mining jobs in Bulletin CR-526-G. Specifications and advantages of each model are cited.

The mammoth TD-24 crawler is shown shoving iron ore off a special ramp into a side dump. The International Drott TD-9 skid-shovel is pictured powering jumbo drills in a uranium mine and the TD-6 loading blasted ore 107 ft underground. Other photos show IH Models 65 and 95 Pay-haulers and Models 55 and 75 Pay-scrapers performing tough mining jobs.

new literature

Torque Converter-Drive Tractor Shovels

Operating, performance and maintenance advantages of HD-16G and HD-21G tractor shovels are told by Allis-Chalmers in a new catalog. Pictures and text describe engineering, design and construction features of the two models. They provide the big capacity, cost-cutting and versatility users want, A-C states.

One-Swathe Highway Widener

A new four-page catalog covering the Gar Wood-Buckeye Hi-Way Widener is now available from Gar Wood Industries, Inc. The Hi-Way Widener, powered by a heavy-duty diesel engine, excavates and finish grades a highway widening trench in one pass. Requiring only one man to operate, the machine digs a clean, flat-bottomed trench—up to 18 in. deep and from 24 in. to 48 in. wide—ready for concrete or bituminous material. Pouring can be done without forms or with outside forms only.

Raybestos Data Book

A complete 112-page Engineering Data Book on the design and selection of Poly-V belt drives has been issued by Manhattan Rubber Division, Raybestos-Manhattan, Inc. This manual should prove a useful tool for anyone concerned with belt-drive installation or maintenance.

Generously illustrated, the book contains many useful charts, tables and diagrams along with complete specifications for all drive sizes. Proper selection of Poly-V belts and sheaves for drives of any speed or horsepower rating is made easy, without calculation, by standard drive tables.

The book covers both theory and the practical application of the new R/M Poly-V drive, along with numerous illustrated case histories. In addition, detailed data on V-belt drives is included—drive tables, horsepower ratings, installation instructions and trouble shooting.

For your copy of this comprehensive handbook, fill in the reply card in the back of this magazine.

Inside Story On Balancing Machines

Taylor Dynamometer & Machine Co. offers a graphic piece on HI-EFF precision balancing machines.

A cutaway sequence reveals the inside story of operation and advantages of Taylor balancing equipment. Operation ease of speed-button control and versatility of spindle design are cited. Capacities and dimensional data are given. Photographs show typical piece-parts which can be balanced on their machines.

Lubrication Fittings Application Guide

Alemite catalogs hundreds of lubrication fittings for ready reference in selecting the right fitting for every requirement.

They range from the pin-type fitting to the newest "Red Ball" hydraulic fitting. Also included are relief, measuring and drive fittings and other special purpose fittings. Specifications and dimensions for each fitting are given ready for transfer to blueprints.

More than one hundred Quincy Authorized Service Depots throughout the country carry adequate stocks of genuine factory parts for all models of Quincy Compressors. So wherever you are, you know you can put extra confidence in your Quincy Compressors. They're built to give you the kind of service needed for jobs like diesel starting, operating air tools and controls — designed to stand up under rugged field conditions. Depend on Quincy Compressors and Quincy service for all your needs from 1 to 90 CFM. Write Dept. J-55 for catalog today.

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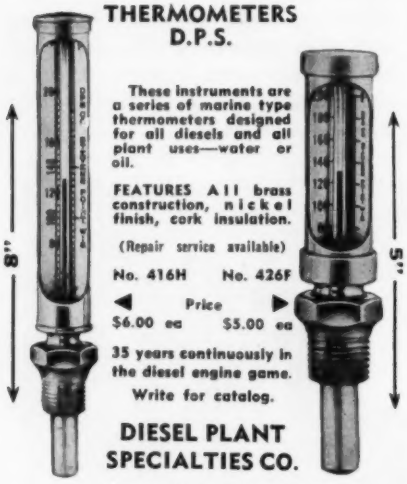

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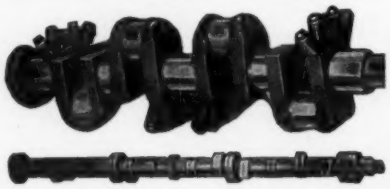

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Service Section

(*Continued from Page 63*)

IH Cylinder Head

The distributing tube is installed by removing the front head bolt seal tube. To remove the tube, press or punch tube from the combustion side of the cylinder head. Working from combustion chamber side of cylinder head, remove restrictions such as casting flash, scale and core wires from inside of water jacket.

Install distributing tube with a minimum of pressure to prevent collapsing tube. Coat head bolt seal tube with white lead to prevent leakage and re-install. Butt distributing tube against seal tube and flare tab on distributing tube as shown to maintain tube in position.

The coolant distributing tube has IH part No. 169 069 R1. Until stock of tubes is available they can be made from the dimensions given.

Use 1-in. ID soft copper tubing with 1/32-in. wall thickness cut to 20½-in. length. Partially flatten tube then insert 1-in. wide by ½-in. thick 24-in. long piece of steel into the copper tube and flatten under press to form distributing tube as illustrated. Cut end of tubing as illustrated to permit flaring.

GM Torquing Bolts

ings on their heads identifying their grade, which is an indication of their tensile strength and hardness.

Torque recommended for a particular size bolt will vary with the material of which it is made, the material into which it is threaded, the character (type) of casting into which it is threaded, and the peculiarity of the part which it retains. One example of this on the Series 71 engine is the idler gear hub bolt, Part No. 186689; a grade-8 bolt with a size of ½—13 x 2-in. (½-in. diameter—13 threads per inch and 2-in. in length) and having a tensile strength of 150,000-psi. This bolt is capable of being torqued to a maximum of 105-110 lb ft. In the Series 71 engine this bolt should be torqued to 80-90-lb ft if the engine has a cast iron block, but 50-55-lb ft if block is aluminum.

Normally, bolts threaded into aluminum or cast iron have coarse threads whereas the same diameter bolt threaded into steel will have fine threads.

Torques listed in the torque tables, with few exceptions, are for bolts completely cleaned, dried, and are entering clean dry holes. Exceptions are main bearing and cylinder head bolts that have been completely cleaned and lubricated before assembly.

Over-torqued bolts become abnormally stretched resulting in thread damage and may also cause warpage and misalignment of engine parts. Under-torquing may cause fluctuation in bolt stress resulting in a tendency to fatigue and break or work loose.

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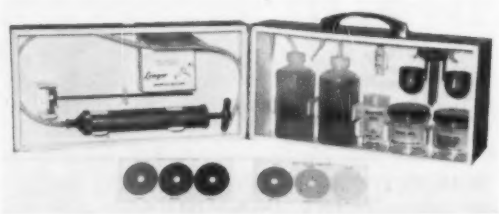

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BEARD and STONE
FUEL INJECTION — ELECTRICAL — CARBURETOR
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organizational news

(*Continued from Page* 81)

New Chicago Rawhide Facility

Chicago Rawhide Mfg. Co. has opened the special Polymer section of its Sirvene Division. Here they will manufacture oil seals, diaphragms, packings and other custom molded parts. This facility adds 12,500 sq ft to the Division's existing 121,000 sq ft. Completely air filtered and temperature controlled, it will house a research and development laboratory as well as control of all its production.

In Memorium

Vsevolod Nicholas Stankoff at the age of 72 died on April 29 after a brief illness. He was chief engineer of Barnes & Reinecke, Inc. At his passing, he had been working on development of an entirely new type of compression-ignition engine for Army, Navy and commercial projects of his company. Mr. Stankoff was a member of ASME and SAE.

P & H Sales Manager

Harnishfeger Corp. has named J. F. Catalane sales manager of the Power & Shovel Division. With P & H since 1952, his previous experience includes sales positions at Cinrock Machinery Co. and Gar Wood Industries.

Succeeding Mr. Thorpe as district manager of the Florida territory is J. E. Laffey.

Amot Expands

Amot Controls Corp., Richmond, Calif. has enlarged its plant and office area to three times its former size. Expansion was necessary because of increased activity in development and research of engine controls. More space was needed too, Amot says, for increased business in engine thermostatic, locomotive engine and safety controls.

Recent appointments at Amot have been: T. Gartrell, vice president and general manager; B. W. West, vice president and production manager; P. E. Letchworth, sales manager, and A. M. Newhall, chief engineer.

Kittell Appoints Three

Kittell Muffler & Engineering, Inc., Los Angeles, announced three new representatives for their line of industrial, marine and mobile silencers and spark arrestors.

E. C. Schum will cover Indiana, Ohio and Kentucky. F. O. Walsh, Jr. will handle sales in Tennessee, the Carolinas, Alabama, Georgia and Florida. Thomas E. Neal is allotted the territory of Illinois and Michigan.

New Lab for Eaton

Eaton Mfg. Company is constructing a new test laboratory in Tonawanda, N. Y., for research and development of components for industrial gas turbines. The 13,000-sq ft building will house complete engine testing facilities for hot and cold tests, air blowing machinery, dynamometers, torque measuring apparatus, and an instrument control room, as well as office and work shop areas.

The facility will be operated by Eaton's Fredric Flader Division.

These Controls Provide:

SIGNAL LIGHTS
•
AUDIBLE ALARM TERMINAL
•
PUSH BUTTON SILENCER
•
ALARM TEST PUSH BUTTON
•
TOGGLE SWITCH FOR TURNING "ON" CONTROL
•
VISUAL "POWER ON" SIGNAL LIGHT

Synchro-Start
SAFETY ALARM SETS

Synchro-Start Alarm sets contain all the necessary relays, switches and signal lights to warn the operator of any abnormal condition existing in the engine.

Signal lights for low oil pressure and high water temperature are standard. These sets can be furnished with as many as seven failure signals to guard against high oil temperature, low air pressure, low fuel level, etc.

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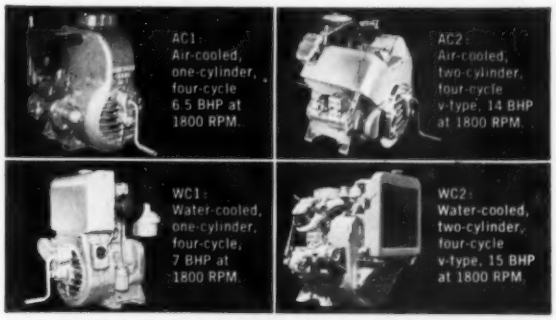
AMERICAN MARC Inc. dominates the field of lightweight, low-horsepower Diesels by building its diversified line from the "Big Four" basic models illustrated here. Purchase and maintenance of engines and parts are simplified by the use of these compact and rugged prime movers.


AC1: Air-cooled, one-cylinder, four-cycle 6.5 BHP at 1800 RPM.
AC2: Air-cooled, two-cylinder, four-cycle v-type, 14 BHP at 1800 RPM.
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WC2: Water-cooled, two-cylinder, four-cycle v-type, 15 BHP at 1800 RPM.

AMERICAN MARC also manufactures Diesel generating plants from 3 to 10 KW (AC or DC, and industrial three-phase), Diesel pumping units from 4 to 1700 GPM, marine propulsion, refrigeration units and power-packages for other services. American MARC can adapt any of its Big 4 engines to fit every job requiring from 5 to 20 BHP.

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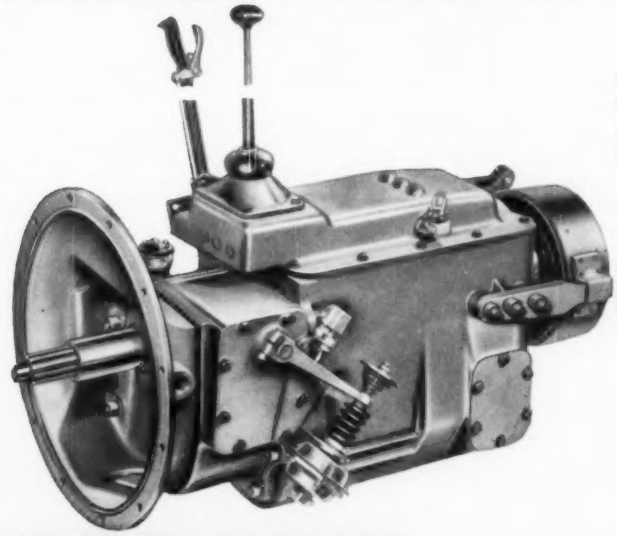
CLARK stepMatic Transmission



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- Ten speeds—splitting ratios in between the normal 5-speed transmission ratios—giving 28% steps to fit every hauling need.

Transmission gears synchronized. Semi-automatic shift for the splitting ratios

- Full control of gear-shifting at all times.
- Spares engine—the right ratio for every grade prevents engine lugging—decreases hauling time and fuel consumption.
- Increases transmission life—reduces shock loads. Less downtime for repairs.

By all means write for full information on this highway-proved achievement of Clark engineering.

CLARK® EQUIPMENT

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CLARK EQUIPMENT COMPANY

Falahee Road • Jackson 11, Michigan

Neodesha packs 1-2 performance punch

1 | *Nordberg Diesels* 2 | *STANODIESEL Oil M*

Operator J. N. Finkinbinder (left) and Everett Powell, Neodesha Superintendent of Electric and Water Plants, adjust rocker arm assembly of Nordberg Duafuel Engine. Engine operated 40,431 hours before overhaul, carrying about 90% of load. All engines in service at Neodesha are Nordberg's. All use Standard Oil's STANODIESEL Oil M.

Finkinbinder and Powell inspect oil filter used for filtering STANODIESEL Oil M used in all six Nordberg Diesels at Neodesha, Kansas, power station.

Quick facts about STANODIESEL OIL M

- Keeps crankcase, pistons, cylinder walls clean.
- Combats deposit and wear problems imposed by using economy fuels.
- Maintains film on difficult to lubricate parts.
- Eliminates spark plug fouling in spark-ignited gas engines and reduces combustion chamber ash and deposits in engines burning natural gas, LPG and liquid fuels.
- Eliminates fuel injector and pump sticking caused by deposits on injector barrel and plunger where fuel and lube oil mix.

The city of Neodesha, Kansas, has six Nordberg engines in service. They have operated more than 400,000 hours on Standard Oil diesel lubricating oils. Here is the case story of one of these engines. The performance of this engine is typical.

In 1952, the city of Neodesha installed a 1,750 hp., 1230 kw., Nordberg Duafuel engine. During the period between February 14, 1952, when the engine went into service, and March 1, 1956, the engine ran 34,370 hours out of a possible 35,784. This is 96% of the engine's total installed hours. In this time, not even a piston or cylinder head was removed. So good was the performance of this engine using STANDARD HD Oil that when Standard introduced an improved diesel oil—STANODIESEL Oil M—in February, 1955, this engine was converted to this new oil.

There is more to the story. The engine continued in service to 36,223 hours when No. 7 cylinder liner was pulled to put rubber gaskets on liner to stop water leakage. At this time, No. 7 piston and liner were checked. Liner wear averaged only 0.0045 inches. The top ring showed an average wear of 0.016 inches. The No. 2 ring was 0.020 inches. Little, if any, wear was indicated on other rings. Now, at 40,431 hours, the engine is down for overhaul of turbocharger and to have valves ground. Bearings were found in excellent condition. No pistons are to be pulled.

Get more facts about STANODIESEL Oil M by calling the Standard Oil office near you in any of the 15 Midwest and Rocky Mountain states. Or write Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD

STANDARD OIL COMPANY
(Indiana)